C.

THE TRANSACTIONS OF THE ACADEMY OF SCIENCE OF ST. LOUIS.

VOL. I. 1856—1860.

WITH 21 PLATES, ILLUSTRATING PAPERS.

ST. LOUIS:
GEORGE KNAPP & CO., PRINTERS AND BINDERS.
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OFFICERS

OF THE

ACADEMY OF SCIENCE OF ST. LOUI

For 1857.

PRESIDENT,

BENJAMIN F. SHUMARD, M.D.

FIRST VICE PRESIDENT,

ADOLPHUS WISLIZENUS, M.D.

SECOND VICE PRESIDENT,

CHARLES P. CHOUTEAU, Esq.

CORRESPONDING SECRETARY,

NATHANIEL HOLMES, Esq.

RECORDING SECRETARY,

J. S. B. ALLEYNE, M.D.

TREASURER,

SIMON POLLAK, M.D.

CURATORS,

B. F. SHUMARD, M.D.
Dr. ALBERT C. KOCH.
CHARLES W. STEVENS, M.D.
JOHN LEBRECHT, M.D.

LIBRARIAN,

THEODORE C. HILGARD, M.D.

STANDING COMMITTEES.

COMMITTEES.	CHAIRMEN.
Ethnology,	A. Wislizenus, M.D.
Comparative Anatomy,	Prof. C. A. Pope.
Mammalogy,	Prof. C. W. Stevens.
Ornithology,	Edward Wyman, Esq.
Herpetology and Ichthyology,	Prof. M. M. Pallen.
Chemical Geology and Malacology,	H. A. Prout, M.D.
Entomology,	Prof. W. M. McPheeters.
Botany,	T. C. Hilgard, M.D.
Palæontology and Geology,	Benj. F. Shumard, M.D.
Mineralogy,	John Moss, Esq.
Chemistry,	Prof. A. Litton.
Physics,	Jas. B. Eads, Esq.
Embryology,	E. H. Gregory, M.D.
Monstrosities,	J. S. B. Alleyne, M.D.
Library,	Geo. Engelmann, M.D.
Publication,	Prof. W. M. McPheeters.

CHARTER.

AN ACT TO INCORPORATE THE ACADEMY OF SCIENCE OF ST. LOUIS.

Be it enacted, by the General Assembly of the State of Missouri, as follows:

SECTION 1. That George Engelmann, Hiram A. Prout, Nathaniel Holmes, Benjamin F. Shumard, Charles W. Stevens, James B. Eads, Moses M. Pallen, Adolphus Wislizenus, Charles A. Pope, Charles P. Chouteau, William M. McPheeters, and others—who have heretofore formed an association in the city of St. Louis styled "THE ACADEMY OF SCIENCE OF ST. LOUIS," having for its object the advancement of Science, and the establishment in said city of a Museum and Library for the illustration and study of its various branches—their associates and successors, are hereby declared and created a body corporate by the name and style aforesaid; and by that name they shall have perpetual succession, may sue and be sued, implead and be impleaded, in all courts of competent jurisdiction; may acquire by purchase, gift, or devise, receive and hold, property, real, personal, or mixed, and the same exchange, sell, lease, or otherwise dispose of, as they may deem proper, for the objects and purposes aforesaid, and not otherwise; may have a common seal, and break or alter the same at pleasure; and may make such constitution, regulations, and by-laws, as may be requisite for the government thereof, not being contrary to the laws of the land, and may alter the same at pleasure.

SEC. 2. The constitution and by-laws of said association now in operation shall govern the corporation hereby created until the same shall be regularly altered or repealed, and the present officers of said association shall be officers of this corporation until their respective terms of office shall expire, or be vacated in pursuance thereof.

Sec. 3. The property and effects now belonging to the association aforesaid shall, on acceptance of this charter, thereby become vested in the corporation herein created, and all property owned or held by this corporation shall be exempt from taxation so long as the same shall continue to be held and used in good faith for the objects and purposes aforesaid; but whenever any real estate of the corporation shall be leased to any other person or persons, the leasehold interest therein shall be taxable to the lessee or lessees thereof, as in other cases.

Sec. 4. The members of this association acquire no individual property in the real estate, cabinets, library, or other effects thereto belonging, which are hereby declared to be fully vested in the corporation as such; but the interest of the members therein shall be usufructuary merely, and shall not be transferred, assigned, hypothecated, or otherwise disposed of, than as hereinbefore provided.

Sec. 5. Whenever this corporation shall have failed to answer the purposes for which it was created, or shall suffer its charter to be forfeited by the law of the land, its cabinet collections and library shall revert to and become vested in the City of St. Louis, to be deposited with some public institution in said city, for general use and inspection, under such regulations as the said City may prescribe.

Sec. 6. This act shall be taken as a public act, and be in force from and after its passage.

Approved January 17, 1857.

CONSTITUTION.

ARTICLE I.

STYLE.

SECTION 1. This Association shall be called "THE ACADEMY OF SCIENCE OF ST. LOUIS."

ARTICLE II.

OBJECTS.

SECTION 1. It shall have for its object the promotion of Science: it shall embrace Zoology, Botany, Geology, Mineralogy, Palæontology, Ethnology (especially that of the Aboriginal Tribes of North America), Chemistry, Physics, Mathematics, Meteorology, and Comparative Anatomy and Physiology.

SEC. 2. It shall furthermore be the object of this Academy to collect and treasure Specimens illustrative of the various departments of Science above enumerated; to procure a Library of works relating to the same, with the Instruments necessary to facilitate their study, and to procure original Papers on them.

SEC. 3. It shall also be the object of this Academy to establish correspondence with scientific men, both in America and other parts of the world.

ARTICLE III.

MEMBERS.

SECTION 1. This Academy shall be composed of two classes of members—Associate Members and Corresponding Members.

SEC. 2. The Associate Members shall constitute the main body of the Academy, and shall exclusively conduct its affairs, elect its officers, admit its members, etc. They shall be men desirous of cultivating one or more branches of Science above enumerated. They shall pay upon admission an initiation fee of five dollars, and a semi-annual payment of three dollars so long as they continue members.

SEC. 3. Corresponding Members shall consist of men of science, not living in the city and county of St. Louis, who shall be elected such by virtue of their attainments, and of other persons, not resident in the city of St. Louis, who may be disposed to further the objects of the Academy by original researches, contributions of specimens, or otherwise.

SEC. 4. All candidates for admission into the Academy as Associate or Corresponding Members must be proposed in writing by two Associate Members at a regular meeting, and be balloted for at the next regular meeting thereafter. The affirmative vote of three-fourths of the members present shall be necessary to elect a candidate.

SEC. 5. All members shall have the privilege of attending the regular meetings of the Academy, and shall have access to the Library and Museum, with the privilege of introducing to the same their families and friends.

SEC. 6. If any Associate Member elect shall not pay the fee of initiation within six months from the date of his election into the Academy, the election shall be null and void; and if any such member shall not pay the semi-annual contribution within six months after the same has become due, he shall cease to be a member of the Academy: *provided, however*, that every such member who shall be absent from the city or county of St. Louis for the space of six consecutive months, or longer, shall be exonerated from the payment of his dues accruing during his absence.

SEC. 7. If any person shall be balloted for and rejected, or his name be withdrawn previously to the ballot, no entry of said rejection or withdrawal shall be made on the minutes of the Academy.

SEC. 8. No person who shall be thus rejected, or whose name shall be thus withdrawn, previously to the ballot, shall be again proposed for membership before the expiration of six months next succeeding said rejection or withdrawal.

SEC. 9. Any member may resign by notifying the Recording Secretary of such intention, provided he produces to the said Secretary a certificate from the Treasurer that all arrears due from him to the Academy have been discharged.

SEC. 10. Members may be expelled from the Academy by a vote of a majority (not being less than twelve) of the members present, at any regular meeting, for any act of flagrant disrespect to the officers or members, or for any intentional violation of the constitution, or for any grossly immoral conduct: *provided, how-*

ever, that no member shall be thus expelled without having an opportunity of being heard in his own defence.

SEC. 11. No person thus expelled shall, under any circumstances, be re-elected a member of the Academy.

ARTICLE IV.

OFFICERS.

SECTION 1. The officers of the Academy shall be chosen from the Associate Members, and they shall consist of a President, *first* and *second* Vice Presidents, a Corresponding Secretary, a Recording Secretary, a Treasurer, a Board of Curators, and a Librarian. Said officers shall be elected at the first stated meeting in the year, by ballot, and shall hold their offices for one year, or until their successors are elected.

SEC. 2. It shall be the duty of the President to preside over the meetings of the Academy; to nominate all committees other than those specially excepted; to call extraordinary meetings at the request, in writing, of three Associate Members; to give the casting vote, and to sign all orders on the Treasurer.

SEC. 3. The duty of the 1st Vice President shall be the same as those of the President, during his absence; and of the 2d Vice President, the same during the absence of both President and 1st Vice President.

SEC. 4. It shall be the duty of the Corresponding Secretary to conduct all the correspondence of the Academy; to keep correct copies of all letters written by him in such correspondence, and to make regular reports of the same; and to notify all Corresponding Members of their election. And it shall be the duty of the Recording Secretary to keep correct minutes of the proceedings and transactions of the Academy; to keep all reports and other papers read before it, unless their disposal shall be otherwise ordered; to notify all Associate Members of their election; to keep a correct list of the members of the Academy, with the dates of their election, and the dates of resignations, expulsions, and deaths, that may occur among them; and to keep the constitution and common seal of the Academy.

SEC. 5. It shall be the duty of the Treasurer to take charge of the funds of the Academy, and attend to the collection and payment of money; but no money shall be paid by him except on an order of the Academy, signed by the President and countersigned by one of the Secretaries: he shall keep a clear and detailed statement of all receipts and expenditures; shall keep his books accessible to the proper committees appointed for their examination; and he shall lay before the Academy, at the last stated meeting in the year, a statement of all receipts and expenditures during the year; and he shall give security, satisfactory to the Academy, in the sum of five thousand dollars, for the faithful performance of his duties.

Sec. 6. The Librarian shall take charge of all books belonging to, or deposited with, the Academy, and shall be responsible for the same; he shall keep a catalogue thereof, in which the names of contributors shall be inscribed, with the dates of their reception, conformably to the by-laws that may be established for the regulation of his duties; he shall superintend the publication and distribution of all memoirs, essays, and papers, written by members, whenever so ordered by the Academy, and shall attend in the Library at such times as the by-laws may prescribe.

Sec. 7. It shall be the duty of the Curators to have charge of the Museum of the Academy, to supervise the arrangement of all specimens and apparatus belonging to it, to direct the management of it, and to do all things necessary for its preservation and repairs. They shall purchase all articles wanted in the fulfilment of their duties aforesaid, hire janitors, keep the keys of all cases in the Museum, and shall report all additions made to the different departments under their charge, at the last stated meeting in the year.

ARTICLE V.

MEETINGS.

Section 1. The meetings of the Academy shall be held at such times as the by-laws may direct.

ARTICLE VI.

AMENDMENTS.

Section 1. The constitution may be amended in the following manner, viz: Any amendment proposed may be submitted in writing to a regular business meeting of the Academy; it shall lie over for consideration four weeks, when it shall be acted upon at the first regular meeting succeeding the expiration of the above named period, and may be adopted as a part of the constitution by a vote of two-thirds of the members present.

BY-LAWS.

ARTICLE I.

COMMITTEES.

Section 1. There shall be standing committees on the following subjects, viz: Ethnology, Comparative Anatomy, Mammalogy, Ornithology, Herpetology and Ichthyology, Malacology and Chemical Geology, Entomology, Botany, Palæontology and Geology, Mineralogy, Chemistry, Physics, Embryology, and Monstrosities; on the Library, and on Publication.

Sec. 2. These committees shall consist of three members, who shall be appointed at the last regular meeting in January of each year.

Sec. 3. In appointing these committees, the President shall nominate the first member; the first member so nominated shall nominate a second, who shall nominate a third.

Sec. 4. All committees must report in writing, and every report must be signed by a majority of the committee offering it.

Sec. 5. All special committees must report at the regular meeting next succeeding their appointment.

Sec. 6. The standing committees shall have charge, in conjunction with the Curators, of their respective departments; make exchanges of duplicates; arrange and keep in order all donations and deposits, carefully labelling each article, and keep a correct catalogue of all additions to their respective departments, and report at the last stated meeting in January.

ARTICLE II.

LIBRARY.

Section 1. All works in the Library must be classed according to their subjects.

Sec. 2. The Librarian shall keep a correct catalogue of all books belonging to the Academy, the Library of which shall be open to the inspection and use of members.

Sec. 3. There shall be two sets of keys to the cases containing the books, one of which shall be kept by the Librarian, and the other by the chairman of the Library Committee.

Sec. 4. The Library shall be amply provided with chairs, tables, and writing apparatus, for the convenience of members desirous to consult books.

Sec. 5. Members may borrow books, the property of this Academy, from the Librarian, on signing a promissory note for fifty dollars, which shall become void when the book is returned.

Sec. 6. But no works shall be loaned from the hall, on any account whatever, except those marked with an asterisk (*) in the catalogue, unless by an affirmative vote of three-fourths of the members present, at a regular meeting, when the application is made; and in case of deposited books, the written consent of the depositor having previously been obtained: the name of the borrower and the title of the book to be recorded on the minutes, and full security given for its safe return, by note or otherwise, the value whereof shall be determined by the Library Committee.

Sec. 7. No book shall be kept from the Library longer than two weeks. A fine of twenty-five cents shall be imposed for each week that any book is kept over the time laid down in this section.

Sec. 8. No member shall be allowed to renew the loan of a book, if any other member shall be desirous of obtaining it.

Sec. 9. The Librarian and Library Committee shall be responsible for all works committed to their charge.

ARTICLE III.

MUSEUM.

Section 1. No specimen, or apparatus, contained in the Museum of the Academy shall be taken from the hall, under any pretence whatever, unless by vote of the Academy.

Sec. 2. The keys of the cases containing the collections shall be kept by the Curators and members of the respective committees attached to the different departments, who alone shall have liberty to open the cases; and they shall be responsible for all articles committed to their charge. If any member is desirous to inspect more closely the specimens in the collection, for purposes of study or description, he must apply to the Curators, or a member of the committee on that department.

Sec. 3. All articles in the Museum must be kept labelled as far as practicable, and a catalogue of the articles in each department kept by the committee attached to the said department.

Sec. 4. When a member of the Academy deposits in the Museum a sufficient number of articles to fill an entire case, a key of said case shall at all times be at his command.

Sec. 5. Books, or objects of Natural History, deposited with the Academy, shall be returned only on a request of the owners, or their representatives, and in all cases a receipt shall be given to the Curators when the articles are returned.

Sec. 6. No specimen which is not capable of being arranged in the cabinet shall be received on deposit, unless the consent of the committee on the department in which the specimen should be classed, and that of the Curators, be first obtained in writing.

Sec. 7. Visitors may be admitted to the Museum, gratuitously, on Tuesdays and Fridays, from one o'clock until sunset; but strangers in the city may be admitted on every afternoon, between the above named hours, by presenting to the janitor a ticket signed by any Associate Member.

Sec. 8. No children under twelve years of age shall be admitted unless accompanied by persons who will become responsible for their good behavior; and should any damage result to any of the furniture, specimens, or any of the property of the Academy, through any admitted child, pecuniary remuneration shall be made by the person or persons assuming such responsibility; the damages to be assessed by the Librarian and Curators.

ARTICLE IV.

COMMUNICATIONS.

Section 1. All written communications intended for publication, read before the Academy, shall be referred to special committees, who shall report thereon at the regular meeting next succeeding their appointment.

Sec. 2. All such communications become the property of the Academy, and shall be deposited in the archives, and those deemed suitable for publication shall be published when so ordered by the Academy: a copy, however, of any paper read before the Academy may be taken by the author.

SEC. 3. Original papers, on the subjects before enumerated, may be subject to discussion.

ARTICLE V.

MEETINGS.

SECTION 1. The regular meetings of the Academy shall be held on Monday evening of every other week, at hours fixed from time to time by the Academy; no change, however, shall be made except after two weeks' notice given at a regular meeting.

SEC. 2. The order of proceeding, at the regular meetings of the Academy, shall be as follows:

1. Minutes of last meeting read.
2. Reports of committees.
3. Reports of correspondence.
4. Donations to the Museum and Library.
5. Written communications.
6. Verbal communications.
7. Deferred business.
8. New business.
9. Elections.
10. Rough minutes read.
11. Adjournment.

ARTICLE VI.

AUTHORITY.

SECTION 1. In all points of order that are not provided for in these by-laws, Cushing's or Mathias' "Manuals" shall be the standard authority.

TRANSACTIONS

OF THE

ACADEMY OF SCIENCE OF ST. LOUIS.

March 10*th*, 1856.

Dr. George Engelmann in the chair.

After several preliminary meetings respecting the organization of the Society, a meeting was held on the 10th day of March, 1856, in the Hall of the Board of Public Schools, at which were present the following gentlemen, viz: Geo. Engelmann, M.D., H. A. Prout, M.D., Prof. M. M. Pallen, Benj. F. Shumard, M. D., Prof. Chas. A. Pope, Wm. H. Tingley, M.D., Jas. B. Eads, Esq., Prof. Wm. M. McPheeters, S. Pollak, M.D., Prof. Chas. W. Stevens, A. Wislizenus, M.D., N. Holmes, Esq., Prof. M. L. Linton, J. H. Watters, M.D., and Chas. P. Chouteau, Esq. Dr. Engelmann was called to the chair, and Dr. B. F. Shumard appointed Secretary.

Dr. Tingley reported from the committee previously appointed, consisting of Messrs. Tingley, Prout, Shumard, and Holmes, a constitution and by-laws for the government of the Academy, which were adopted; and the following gentlemen were elected officers for the ensuing year, viz.:

President,	George Engelmann, M.D.
1st Vice President,	Hiram A. Prout, M.D.
2d Vice President,	Nathaniel Holmes, Esq.
Secretaries,	Benjamin F. Shumard, M.D. William H. Tingley, M.D.
Treasurer,	James B. Eads, Esq.

Curators,	Prof. M. M. Pallen, A. Wislizenus, M.D. B. F. Shumard, M.D. Prof. C. W. Stevens.
Board of Council,	Dr. Geo. Engelmann, Dr. H. A. Prout, N. Holmes, Esq., Dr. B. F. Shumard, Dr. W. H. Tingley, Prof. C. A. Pope, C. P. Chouteau, Esq.

April 21, 1856.

Prof. C. A. Pope in the chair.

The following gentlemen were elected Associate Members:— Prof. J. B. Johnson, Prof. A. Litton, Dr. Albert C. Koch, Jas. Schiel, M.D., and Messrs. Neré Vallé, M. Lewis Clark, A. Behr, James E. Yeatman, and E. C. Angelrodt.

Dr. Koch proposed to visit, for the benefit of the Academy, a certain locality in the State of Mississippi, where fossil bones, supposed to belong to *Zeuglodon*, had recently been discovered, provided the Academy would bear the necessary expense. The proposition was accepted.

A note was read from Dr. Prout, presenting from Dr. Alexander, of Lexington, a specimen of fibrous gypsum, from the Missouri River.

Dr. Koch presented a lithographic plate of the "*Missourium*" (*Mastodon giganteus*), found by him in Missouri, being the same which is now in the British Museum, and a plate representing a portion of the dermal covering of *Squalodon*.

On motion, it was resolved that the proposition of Dr. C. A. Pope, offering the free use of the Cabinet Hall, and other rooms suitable for the purposes of the Academy, in the Dispensary Building of the St. Louis Medical College, be accepted, with thanks to Dr. Pope for his generous offer.

Mr. Charles P. Chouteau stated that he would place the collection of fossil remains, obtained by Dr. Hayden from the *Mauvaises Terres* and other parts of Nebraska, now in his possession, in the Museum of the Academy, as soon as a place was fitted to receive it. His own interest in the collection, amounting to about one-fourth of the whole, he presented as a donation to the Institution.

This liberality on the part of Mr. Chouteau places the Academy in possession of an extensive and beautiful collection of Mammalian and Chelonian remains from the Eocene Tertiary, together with a large suite of elegantly preserved fossils from the Cretaceous Formation of Nebraska. Among the former may be mentioned specimens of *Oreodon Culbertsonii, O. gracilis, Rhinoceros occidentalis, Titanotherium Proutii, Machairodus primævus, Anchitherium Bairdii*, and *Testudo* (several species); and among the latter are *Ammonites, Scaphites, Baculites, Inoceramus, Arca, Rostellaria, etc.*

On motion, the thanks of the Society were presented to Mr. Chouteau for his munificent donation.

May 19, 1856.

The President, Dr. Engelmann, in the chair.

A letter was read from Dr. A. C. Koch concerning remains of *Zeuglodon*, found in the State of Mississippi.

Dr. B. F. Shumard presented Decade VI. of the Memoirs of the Geological Survey of the United Kingdom of Great Britain.

Dr. Engelmann presented a number of monographs on various scientific subjects.

June 2, 1856.

The President, Dr. Engelmann, in the chair.

Dr. A. C. Koch reported the result of his late explorations in Mississippi and Arkansas. He stated that he had visited a locality, 13 miles from Canton, Miss., on the line of the railroad from Jackson to Canton, where remains of *Zeuglodon* had been exhumed, and which were now in the possession of Mr. Wm. McDowell, of Canton. A portion of the bones were much broken, excepting one large lumbar vertebra and several heads of rib bones. Another portion, better preserved, and more in number, was composed of more important parts of the skeleton, viz: a nearly complete *humerus*, some large lumbar *vertebræ*, two anterior dorsal *vertebræ*, portions of ribs, and the lower jaw (considerably broken), parts of the skull, and the whole of the petrous portion of the temporal bone. Appearances indicated that the larger and better part of the skeleton still remained in the deposit. Other bones were seen at the time of the excavation, but they have since been covered up by the caving down of the marly bank, about 14 ft. thick, in which they are found. He thought the whole could be obtained for the Academy at a cost of about $200.

Dr. Koch stated that he had visited another locality, about 20 miles from Hillsboro, Scott county, Miss. Remains of *Zeuglodon* had been discovered in several places in this neighborhood. At Hillsboro, he saw four lumbar vertebræ of *Zeuglodon macrospondylus*, of small size, which had been brought from a plantation 16 miles distant, and which he had obtained for the Academy. Several others found with them had been destroyed, as he ascertained on visiting the place. The formations of this section of country were the same as those of Vicksburg, Jackson, and Canton, in Mississippi, and Washington Co., in Alabama,—being of the same geological era, the Eocene; and he was not a little surprised to find himself within 90 miles of the place where he had disinterred the large *Zeuglodon macrospondylus*, which is now in the possession of Edward Wyman, Esq., of St. Louis. During his short stay in Scott Co., he had visited several places where similar remains had been found, and, in some, the bones had been exposed in the cultivated fields. One complete rib measured, as he was informed by reliable persons, 9 feet in length; but the specimen had been destroyed through carelessness. There was nothing to be seen, at the spot, now; but he believed the remainder of the skeleton would probably be found on excavating.

Dr. Koch further stated that he had succeeded in making a highly instructive collection of fossils from the Tertiary strata, near Vicksburg, some of which were identical with species found with the *Zeuglodon*.

Dr. Koch presented to the Academy a large and valuable collection of Cretaceous and Tertiary fossils, which he had obtained, in the course of his tour, in the States of Mississippi and Arkansas. Among these were specimens of *Exogyra ponderosa*, *Arca*, *Baculites*, *Hamites*, *Turrilites*, *Pinna*, and claws of a Crustacean of the genus *Callianassa*.

A copy of the first and second Reports of the Geological Survey of Missouri, by Prof. G. C. Swallow, State Geologist, was presented by Dr. Pope; and some catalogues of recent and fossil shells, zoophytes, and minerals, were presented, through Mr. Holmes, by Fred. S. Cozzens, Esq.

Major M. L. Clark exhibited an instrument called the Rotoscope, which he presented to the Academy. Dr. Tingley presented specimens of limestone from Walnut Creek, Kansas Ter.; and Dr. B. F. Shumard, a scorpion, from Syria.

June 16, 1856.

The President, Dr. Engelmann, in the chair.

Letters were read from Prof. A. D. Bache, and Prof. Joseph Henry, of Washington, D. C., from Dr. J. L. Le Conte, of Philadelphia, and from Dr. J. G. Norwood, of Springfield, Ills., elected Corresponding Members; and also, from Messrs. T. L. Snead, R. M. V. Kercheval, F. A. Dick, and H. T. Blow, elected Associate Members.

The following gentlemen were elected Corresponding Members: Prof. Geo. C. Swallow, F. V. Hayden, M.D., and Messrs. Alexander Culbertson, A. Giroux, C. Galpin, H. Hodgkiss, C. M. Deming, Alex. Dawson, and A. Kipp.

The following gentlemen were elected Associate Members:— S. R. Clarke, M.D., Edward Wyman, Esq., N. D. Tirrell, Esq., J. D. Lowe, Esq., John Evans, M.D., Enno Sander, M.D., Hon. Samuel Treat, Albert Todd, Esq., J. S. B. Alleyne, M.D., Louis Boisliniere, M.D., David G. Tandy, M.D., John Laughton, M.D., Gustave Fischer, M.D., Prof. John T. Hodgen, and Mr. Richard Bender.

Donations of books and specimens were presented as follows: Decade II. of the Memoirs of the Geological Survey of Great Britain, by Dr. Shumard; three volumes of Congressional documents from the Hon. Luther M. Kennett, by Dr. Shumard; a specimen of eyeless fish (*Amblyopsis astacus*) from the Mammoth Cave, Ky., of petroleum from Arkansas, and rock salt and other minerals from Hallam, near Salzburgh, by Prof. C. A. Pope; an interesting collection of fossils from Nebraska Ter., *Ammonites* from the Cretaceous formation in Arkansas, and other fossil remains from various parts of the United States, by Prof. M. M. Pallen; specimens of *Productus* from the Carboniferous limestone of St. Louis, by Dr. Pope; a chrysalis and butterfly (*Papilio*), by Dr. Engelmann; and some mounted specimens of birds (*Phalaropus solatus*), by Dr. W. H. Tingley.

July 14, 1856.

Vice President Holmes in the chair.

On motion, it was voted to purchase from Mr. Denkler, Taxidermist, a number of mounted specimens of birds from the vicinity of St. Louis.

Several specimens were presented as follows: a collection of shells and other fossils, by Dr. Koch; the stuffed skin of a weasel, by Dr. Pope; a specimen of rattlesnake and two skulls of Sioux Indians, by Prof. Pallen; a collection of several species of river shells from the Ohio, belonging to the genera *Unio*, *Anodonta* and *Alasmodonta*, by Dr. Prout; and a specimen of gutta percha, by Dr. Tingley.

The following gentlemen were elected Corresponding Members: T. Bennett Dowler, M.D., of New Orleans, La.; Prof. Joseph Leidy, of Philadelphia; Prof. J. L. Riddell, of New Orleans, and Dr. E. K. Kane, of Philadelphia.

The following were elected Associate Members: E. H. Gregory, M.D., F. E. Baumgarten, M.D., G. H. E. Baumgarten, M.D., S. Gratz Moses, M.D., and Charles Taussig, Esq.

July 28, 1856.

Vice President, Dr. H. A. PROUT, in the chair.

Dr. B. F. Shumard exhibited some rare specimens of crinoids, from the Carboniferous rocks of Kentucky, Illinois, and Missouri, belonging to the genera *Actinocrinus*, *Dichocrinus*, and *Platycrinus*.

The Secretary presented, as a donation from the Academy of Natural Sciences of Philadelphia, a set of the volumes of its "Proceedings," and the 2d Series of its "Journal." Voted, that the thanks of this Academy be communicated to the Academy of Natural Sciences of Philadelphia for this highly valuable and liberal donation.

M. Auguste Trècul, of Paris, France, was elected a Corresponding Member of the Academy.

August 4, 1856.

The President, Dr. GEO. ENGELMANN, in the chair.

The President stated that he had called this meeting for the purpose of receiving the Library, consisting of 120 volumes, (as per catalogue,) the mineralogical and geological collections, cases, and apparatus, belonging to the Western Academy of Natural Sciences, of St. Louis, which he was authorized to transfer to this Academy.

Dr. Engelmann presented to the Academy 54 volumes of scientific books and pamphlets, and an extensive collection of rocks, minerals, and fossils, together with a cabinet case; and, also, deposited in the Library 147 volumes of scientific works (as per catalogue).

Dr. C. W. Stevens and Mr. C. P. Chouteau presented a large collection of specimens of *Baculites*, *Scaphites*, *Inoceramus*, and other fossils, from the Cretaceous formation of the Upper Missouri, in the Territory of Nebraska; specimens of fossil wood, bones, and shells, from the Tertiary of Nebraska; skulls of buffalo (*Bison Americanus*), the Rocky Mountain goat (*Ovis mon-*

tana), antelope, and fox; a fine head of a buffalo, an Indian pack-saddle, and other Indian implements, collected by them, on their late tour, in the region of the Upper Missouri.

Dr. Stevens remarked that preservatives for objects of Natural History had been left, during their journey, at the different trading posts on the Upper Missouri, and that arrangements had been made by Mr. Chouteau and himself, by which they expected to secure for the Academy an extensive collection of specimens of the Natural History of that region, during the coming year.

On behalf of Col. A. J. Vaughan, U. S. Indian Agent, Dr. Stevens presented the head of a grizzly bear, two stuffed skins of buffalo (entire), three Mountain sheep (*Ovis montana*), and some fossil skulls of mammalia, from Nebraska; also, a specimen of *Belemnitella bulbosa*, from the Cretaceous formation near Fort Pierre; and a tooth of *Mastodon giganteus*, from the Loess of the bluffs at St. Joseph.

Dr. Pope presented, in the name of Gen. Harney, U. S. A., a remarkably large fossil tortoise, from the *Mauvaises Terres* of Nebraska; and, also, deposited in the Museum of the Academy the stuffed skin of a grizzly bear, presented to him by Mr. C. P. Chouteau, and an interesting collection of Cretaceous and Tertiary fossils from Nebraska, and some Indian implements which had been presented to him by Gen. Harney. Among the fossils were *Baculites ovatus*, *Oreodon gracilis*, a tooth of *Elephas primigenius*, and a fossil tortoise; and, also, a remarkably fine pair of antlers of the elk.

Mr. Charles Galpin presented, through Dr. B. F. Shumard, a new species of *Ammonites*, from the Cheyenne River, 100 miles above the forks of that stream. Dr. Shumard remarked that this fossil was very analogous to the forms which characterize the Cretaceous strata of Texas. He had written a description of it, and named it *Ammonites Galpini*, after its discoverer.

Two specimens of the lizards commonly called horned frogs (*Phrynosoma*), from S. W. Missouri, were presented by Dr. C. A. Pope.

Mr. N. Holmes reported that an ordinance had been passed by the City Council of the City of St. Louis, providing for the deposit of the State geological collection, when received, in the Museum of the Academy. Dr. Pollak presented Dumas' *Traité du Chimie* (4 vols. 8vo).

August 11, 1856.

The President, Dr. Geo. Engelmann, in the chair.

A letter was read from Prof. Joseph Henry, of the Smithsonian Institution, in reply to a letter of the Corresponding Secretary, and, also, letters from Prof. Joseph Leidy, of Philadelphia, and F. V. Hayden, M.D., elected Corresponding Members.

Dr. Pollak presented 30 species of fresh-water shells from the Missouri River, belonging to the genera *Unio*, *Anodonta*, and *Alasmodonta*. Dr. Shumard presented 45 species belonging to the same genera, from various positions in the Mississippi Valley. Dr. Engelmann presented specimens of the same from the Illinois River.

Dr. Pope deposited in the Museum a specimen of fossil tortoise (*Testudo Owenii*), from Nebraska, and also various Indian ornaments and implements which had been presented to him by Mr. Giroux.

Several blocks of sandstone from Green River, Muhlenberg Co., Ky., containing impressions resembling horses' feet, were exhibited by Dr. M. L. Linton, who stated that he had seen upwards of a hundred similar imprints at the locality from which these had been obtained; and he desired to hear the opinions of members concerning them. He was inclined to think they were made by horses.

Dr. Shumard was of opinion that the sandstone was of the age of the coal measures, and that the impressions had been carved by the Indians. He cited some instances, where impressions representing the form of human feet, and the feet of birds, have been found, along with rude figures of men and animals, in rocks belonging to the oldest fossiliferous formations. Dr. Engelmann, also, thought the supposed horse-tracks had been cut in the rock by the Indians.

Mr. James B. Eads submitted for the consideration of the Academy the following explanation of the mechanical principles of the Rotoscope:

"The causes producing this interesting phenomenon are four well settled principles in the science of Mechanics, viz: *Gravitation, friction, the tendency of matter in motion to move in right lines, and, as the result of the latter, centrifugal force.*

"There are several modifications of the machine, but the same causes act in all to produce the paradox.

"The instrument in the possession of the Academy consists of a metal ring, on opposite sides of which are two lugs or ears; by one of these the ring is supported upon the pointed end of a vertical rod, having a heavy base to steady it; and across this ring, and supported by a pivot at each lug, is a shaft or spindle, having on its centre a heavy fly-wheel, just large enough to clear the ring. The spindle has a conical socket at each end, into which the pivots enter for its support. The position of the ring is horizontal, and, of course, that of the spindle is the same. When the fly-wheel is made to revolve swiftly, and the ring is rested by its lug upon the vertical rod, the ring begins to revolve also slowly around upon the point of the vertical rod, carrying with it the fly-wheel and shaft, and apparently setting the laws of gravitation at defiance. As the velocity of the wheel decreases, the revolutions of the ring become more rapid, until it gradually sinks below the plane of the horizon, and finally falls off the vertical rod around which it was revolving.

"The revolutions of the ring are caused by the force of gravitation and friction, at that pivot, supporting the fly-wheel shaft, which is nearest the vertical rod.

"*The weight of a shaft in a circular rest is transferred from the bottom of the rest towards that side of it to which the shaft is turning when the shaft is set in motion.*

"The above proposition, I believe, has not hitherto been adadvanced. This fact will be more apparent, if the rest be considerably greater in diameter than the shaft turning in it. The shaft, as it is turned, will roll up towards one side of the rest; and the greater the friction, the higher up this inclined plane will it rise. If the rest were free to move in a horizontal plane, the weight of the shaft acting upon this inclined plane would urge it forward, just as a lubricated wedge would be expelled by a superincumbent weight. The greater the elevation which the shaft is enabled to attain by its friction on the side of the rest, the more rapidly would it urge it forward; just as the greater the angle of the wedge, the more rapidly would it be expelled.

"Suppose the ends of the fly-wheel shaft were supported in circular rests, instead of by the pivots; then, the wheel being set in rapid motion, the rest nearest to the vertical rod, having the weight of the wheel and shaft upon it and being free to move in a horizontal plane round the point of the vertical rod, would immediately begin to revolve around that point. *Velocity lessens friction.* As the fly-wheel revolves *slower*, the friction at the pivot is *increased*. The shaft is enabled, therefore, to attain a higher angle upon the rest or inclined plane on which it is whirling. Thus, as the fly-wheel loses its speed, the shaft is working on an inclined plane of greater angle, and the ring is consequently urged round more rapidly.

"The shaft being supported by pivots in its hollow ends, instead of in the manner just described, does not alter the case at all, except to reverse the direction of the ring. The friction of the shaft on the pivot transfers its weight from the top of the pivot to the side of it, and thus the inclined plane is found, and is urged forward as in the other case.

"If the motion of the ring be accelerated, the outer end of the shaft rises above the plane of the horizon; if it be retarded, the end of the shaft sinks below it.

"By observation, it will be seen that, in accelerating the motion of the ring, the pivot at the outer end of the shaft is pressed against that side of the shaft which is whirling upward, and it immediately brings the pivot above the horizon. If the ring be retarded, the pivot is pressed against the opposite side of the shaft which is whirling downwards, and the result is that it immediately sinks.

"When a counterpoise is placed on the opposite side of the vertical rod from the ring, and the latter is lowered considerably below the horizon, the revolutions of the ring are made in an opposite direction. This result will not take place if the wheel be running at a very high speed. When it loses its rapidity, the friction at the lower pivot is much increased. The socket is pressed upon it by the weight of the wheel, and the same direction of motion is imparted to the ring which the wheel itself has. This is a contrary direction to the previous course of the ring, as will be seen by holding the spindle perpendicular to the horizon.

"Every movement of the ring can be readily explained by the action of gravity and friction at one or the other, or at both points supporting the fly-wheel shaft; and all the motions of the instrument will be found to correspond in every particular with the results to be produced by the causes given above.

"The revolutions of the ring being once understood, the paradox disappears. The tendency of bodies in motion to move in right lines is manifested by matter revolving in a plane. If the ring be held in the hand, and the fly-wheel be in rapid motion, considerable force will be found necessary to divert the wheel from the plane in which it is whirling. This makes it resist any sudden tendency to fall to the earth, and causes it to need but a slight degree of centrifugal force to preserve its shaft in a horizontal position, although supported at but one end. This centrifugal force is furnished by the revolutions of the ring around the point of the vertical rod; and the loss of this ability of the fly-wheel to resist, in a greater degree, the force of gravity, as it loses its velocity, is beautifully compensated by the increased velocity of the revolutions of the ring, which thus generate an increase of centrifugal force to aid in sustaining it."

Messrs. F. B. Meek, of Albany, N. Y., and Henry Pratten, of Springfield, Ills., were elected Corresponding Members.

August 25, 1856.

Vice President HOLMES in the chair.

A letter was read from W. G. Binney, Esq., of Germantown, Pa., requesting an exchange of the Land Shells of Missouri and the neighboring States for the Marine Shells of the Atlantic coast.

Referred to the Secretary, with directions that the request be complied with as far as practicable.

Letters were read also from Prof. J. L. Riddell, of New Orleans, La., and Mr. Henry Pratten, of Springfield, Ills., elected Corresponding Members.

On motion, the chairmen of the several standing committees, not yet appointed, under the constitution of the Academy, were appointed, as follows:

COMMITTEES.	CHAIRMEN.
Ethnology,	Dr. Adolphus Wislizenus.
Comparative Anatomy,	Prof. Charles A. Pope.
Mammalogy,	Prof. Charles W. Stevens.
Ornithology,	Mr. Edward Wyman.
Herpetology and Ichthyology,	Dr. Moses M. Pallen.
Chemical Geology and Malacology,	Dr. Hiram A. Prout.
Entomology,	Prof. W. M. McPheeters.
Botany,	Dr. George Englemann.
Palæontology and Geology,	Dr. Benj. F. Shumard.
Mineralogy,	Dr. J. Schiel.
Chemistry,	Prof. A. Litton.
Physics,	Mr. James B. Eads.
Embryology,	Dr. E. H. Gregory.
Monstrosities,	Dr. J. S. B. Alleyne.

Prof. Louis Agassiz, of Cambridge, Mass., and Prof. Robley Dunglison, of Philadelphia, were elected Corresponding Members; and Prof. G. Seyffarth, and Messrs. Alex. Leitch, Kenneth Mackenzie, Benj. McDonald, Benj. O'Fallon, Spencer Smith, and Wm. Taussig, were elected Associate Members.

September 8, 1856.

Vice President, Dr. H. A. Prout, in the Chair.

Letters were read from Prof. Robley Dunglison, of Philadelphia, and from Mr. H. Hodgkiss, of Fort Clark, Nebraska Ter., elected Corresponding Members, and from Prof. Seyffarth, of Concordia College, St. Louis, elected an Associate Member.

Dr. C. A. Pope presented a fine specimen of *Heliophyllum Halli*, a *Chaetetes*, and a *Spirifer*.

Dr. S. Pollak presented from Mr. Belcher, of St. Louis, a diagram of the Artesian Well at Belcher's Sugar Refinery, in this city. [*See engraved copy below.*]

Dr. Wislizenus presented a valuable collection of rocks, minerals, and ores, collected by him, during his explorations, while connected with Col. Doniphan's Regiment, in New Mexico.

A paper was read by Dr. B. F. Shumard, entitled, "Descriptions of new species of Fossil Shells, from the Cretaceous Formation of Nebraska; by John Evans, M.D., and B. F. Shumard, M.D." Referred to a committee consisting of Drs. Pope, Wislizenus, and Stevens.

Prof. James Hall, of Albany, N. Y., Henry King, M.D., of Georgetown, D. C., B. B. Brown, M.D., of Sacramento, Cal., Ferdinand Lindheimer, M.D., of New Braunfels, Tex., Kirtly Ryland, M.D., of St. Clair Co., Ills., and Messrs. George Bunsen, Charles Bunsen and Adolphus Reuss, were elected Corresponding Members; and Drs. Montrose A. Pallen, Abner Hopton, J. M. McKeage, R. W. Oliphant, J. B. McDowell, and Messrs. M. Schuster, Rob't K. Woods, I. W. Taylor, James Smith, George Partridge, Wm. H. Smith, and George Smith, were elected Associate Members.

September 22, 1856.

Vice President Holmes in the chair.

Dr. Stevens presented a stuffed fawn.

Dr. Schiel presented a rare collection of horned lizards (*Phrynosoma*) and other reptiles, chiefly from the Humboldt River and the base of the Rocky Mountains.

Dr. Shumard exhibited pencil drawings of some new fossil crinoids, intended to illustrate a paper which he had in preparation.

Dr. Schiel read an interesting paper on *Glycerine*, in which he advanced some new propositions respecting the chemical properties and affinities of that substance. Referred to a committee consisting of Drs. Prout, Litton, and McPheeters.

Dr. McPheeters desired to know if Dr. Schiel had made any experiments touching the therapeutic applications of Glycerine.

Dr. S. replied that he was engaged in some investigations of that kind, and that the results would be communicated to the Academy. He was of opinion that Glycerine would be found a useful agent in cases where there was a tendency to the formation of renal calculi. He also thought that vapors of Glycerine would be useful in catarrhal affections. The method of obtaining these vapors was very simple: it was only necessary to drop the substance on a hot plate,—Glycerine evaporating at a temperature of 120°.

Dr. Schiel exhibited, in illustration of his experiments, some very ingenious and delicate apparatus.

The committee to whom was referred the paper read by Dr. B. F. Shumard, on some new species of Fossil Shells of the Cretaceous formation of Nebraska, recommended the same for publication in the Transactions.

Messrs. William Snyder, of Belleville, Ills., and John F. Snyder, of Bolivar, Mo., were elected Corresponding Members; and Rev. Wm. Homes, Wm. S. Golding, M.D., T. L. Rives, M.D., Christian Hausmann, M.D, J. R. Barrett, Esq., Col. D. H. Armstrong, Charles Roesch, M.D., Hermann Roesch, M.D., Hon. Henry S. Geyer, R. S. Elliott, Esq., Wm. Palm, Esq., G. B. Allen, Esq., and the Hon. Edward Bates, were elected Associate Members.

October 6, 1856.

Vice President, Dr. H. A. PROUT, in the chair.

Dr. Prout exhibited specimens of a new species of *Productus*, from the Carboniferous limestone of St. Louis, of which he was preparing a description, under the name of *Productus marginicinctus.*

Dr. Schiel made some remarks on the Bi-sulphuret of Carbon, specimens of which were exhibited. He observed that Dr. Turnbull had made use of this article, as a local application, in the treatment of diseases of the eye. When applied to the eye, or the surface of the body, it produced, at first, a sensation of cold; this was followed by irritation and burning. Dr. Schiel had made a compound, consisting of bi-sulphuret of carbon, 2 parts; alcohol, 2 parts; chloroform and camphor, each, 1 part; which he had used, locally, in Tic Doloureux, Toothache, and Bilious Cholic, with marked effect, affording almost instant relief from pain. Bi-sulphuret of carbon was made by passing the vapors of sulphur over burning charcoal.

A letter was read from the Rev. John Higginbotham, of St. Louis, presenting to the Academy five books, containing 212 plants and shrubs, which had been collected in this neighborhood and in the State of Louisiana, in 1828–9, by the late Rt. Rev. Dr. Rosati, Bishop of St. Louis. A larger part of the collection had been lost in the great fire of 1849.

Gen. Wm. S. Harney, U. S. A., Col. A. J. Vaughn, U. S. Indian Agent, John H. Rauch, M.D., of Burlington, Iowa, John B. Jackson, M.D., of Boston, Mass., H. P. Goodrich, D.D., of Carondelet, Mo., Prof. L. P. Yandell, of Louisville, Ky., and Maj. Carey H. Fry and Dr. J. C. Henry, of Ft. Union, N. Mexico, were elected Corresponding Members.

The following gentlemen were elected Associate Members:—Gerard Eyssen, M.D., J. H. McKellops, M.D., John Lebrecht, M.D., Emil Seeman, M.D., Hon. Alexander Hamilton, B. F. Hickman, Esq., and Messrs. Leopold Gast, Andrew Krug, John Moss, H. E. Bridge, W. C. Buchanan, Jno. Cavender, Jos. Charless, L. V. Bogy, Geo. I. Barnett, John P. Bates, Jno. S. Cavender, Felix Costé, Rob't Carr, G. F. Filley, and E. A. Filley.

November 17, 1856.

Dr. C. A. Pope in the chair.

A letter was read from Wm. H. Tingley, M.D., resigning the office of Secretary of the Academy and his membership, having changed his place of residence.

Letters were read from John H. Rauch, M.D., of Burlington, Iowa, and John B. Jackson, M.D., of Boston, elected Corresponding Members; and from T. L. Rives, M.D., elected an Associate Member.

A letter was read from Dr. Edward Hallowell, of Philadelphia, proposing to exchange specimens of Reptiles for those of the South and West. The proposition was accepted and the matter referred to the Secretary, to be carried into effect as far as practicable.

Dr. C. A. Pope presented a specimen of *Mygale Hentzii*, commonly known as the "Tarantula," from near Pratte's Landing, Missouri, 70 miles below St. Louis.

Mr. C. P. Chouteau presented several Indian hoes, made of flint, found a few miles west of St. Louis.

Dr. C. W. Stevens was elected Recording Secretary, in place of Dr. Tingley, resigned.

Lieut. G. K. Warren, U. S. A., was elected a Corresponding Member; and Messrs. Samuel Gaty, Benj. Farrar, John How, Alex. Kayser, Louis Holm, John O. Farrar, C. C. Zeigler, and Henry Kayser, were elected Associate Members.

December 15, 1856.

Vice President, Dr. H. A. Prout, in the chair.

Dr. C. A. Pope presented specimens of the "Tarantula" (*Mygale Hentzii*), and the Centipede (*Scolopendra heros*), from Texas.

Dr. S. Pollak presented from E. C. Angelrodt, Esq., six pamphlet volumes of works by Ehrenberg, on Microscopic Infusoria.

Voted, that the offer of Mr. E. C. Angelrodt to purchase for the Academy a copy of the large work of Ehrenberg, on *Infusoria*, be accepted on the terms proposed.

Voted, that the Academy would subscribe for the forthcoming work of Agassiz, on the Natural History of the American Continent.

A Paper was read by Dr. H. A. Prout, on a new species of *Productus* (*P. marginicinctus*), from the Carboniferous Limestone of St. Louis.

Ordered, that the Paper and accompanying Figures be published in the Transactions.

Edward Holden, Esq., of Jackson Co., Ills., Capt. John Pope, U. S. A., Lieut. F. T. Bryan, U. S. A., Hermann Behr, M.D., of San Francisco, and George Steele, M.D., of Austin, Texas, were elected Corresponding Members.

The following gentlemen were elected Associate Members:—John E. Goodson, Esq., Thomas McMartin, M.D., Frederick Hauck, M.D., Britton A. Hill, Esq., and Messrs. Geo. R. Robinson, Emmett McDonald, and Benjamin Soulard.

December 29, 1856.

Vice President, Dr. H. A. Prout, in the chair.

A letter was read from Dr. Abbadie, U. S. A., elected an Associate Member.

Dr. A. C. Koch presented specimens of sulphuret of lead, and calamine, from the county of Lawrence, in the State of Arkansas; also, magnetic iron ore and quartz from Hot Springs Co., and granite from a point on the Arkansas 60 miles above Little Rock. Dr. Koch also stated that he had found a bed of coal, resembling the cannel coal, near Batesville, in that State.

Dr. B. F. Shumard presented, in the name of his brother, Dr. Geo. G. Shumard, specimens of gum mezquite from Texas, and gypsum from the Upper Red River, Texas; and, also, an ancient Indian skull from a mound on White River, in Arkansas. This skull had been obliquely flattened by compression in the frontal and occipital regions, and expanded in the direction of the biparietal and vertical diameters. He could not give an accurate description of the mound, nor state the circumstances under which the skull was found; but he would endeavor to ascertain the facts with certainty in regard to it.

Mr. N. Holmes remarked that it would be a matter of much interest to determine the age of the mound. It was well known that the practice of artificially flattening the skull had prevailed among the Natchez, Choctaws, and other tribes of the Lower Mississippi and the Gulf of Mexico, and among the modern Nootka-Columbian Indians. Some of these tribes of the Gulf had been known, also, to build small mounds over the graves of their dead, within the historic period. This method of oblique flattening, as well as that of flattening and elongating the head in the backward direction, by compression in the frontal and parietal regions, had been practised among the ancient Peruvians. If this mound were shown to belong to the age of the Mound-Builders of the Mississippi Valley, or to a still earlier age, and the position of the skull in the mound were well ascertained, it might furnish evidence that the practice of flattening the skull had prevailed to a wide extent, on this continent, at a date long anterior to all historic record.

Mr. N. Holmes presented from Edward Holden, Esq., a pamphlet printed about the year 1631, written by James, King of Scots, and addressed "to the Noble Tycho Brahe, Lord of Knudstrup, the Chiefe Astronomer of this age," containing some curious speculations on comets, and other matters touching the state of astronomical science at that day.

Prof. G. Seyffarth read a Paper on an ancient Assyrian brick, giving an interpretation of the cuneiform characters inscribed upon it. The brick is now in the possession of Prof. C. A. Pope, of this city. It was taken from the ruins of Nineveh, near Mosul, and sent to him by Mr. Marsh, Missionary at Beyrout. At the request of Dr. M. M. Pallen, Prof. Seyffarth explained the manner in which, in the course of extended researches into the structure of the ancient languages of the East, he had arrived at his method of decyphering the arrow-head inscriptions.

On motion, it was ordered that the Paper read by Prof. Seyffarth, together with a plate of the inscription, be published in the Transactions.

Dr. T. C. Hilgard read a Paper on *Phyllotaxis*, giving an explanation of its numerical and divergential law, under a simple organological idea. Referred to a committee consisting of Drs. H. A. Prout, A. Wislizenus, and M. M. Pallen.

The following gentlemen were elected Corresponding Members: Dr. Wheeler, of Perryville, Mo., Col. Charles Whittelsey, of Cleveland, Ohio, and Warwick Hough, Esq., of Jefferson City, Missouri.

The following were elected Associate Members: Thos. Reyburn, M.D., George R. Taylor, Esq., and Messrs. Conrad Witter and Thos. E. Tutt.

January 12, 1857.

Vice President Holmes in the chair.

Prof A. Litton exhibited specimens of *Aluminum*. He gave a brief history of its discovery, and of the later methods which have been invented for obtaining the metal from the common clay. It was now highly probable that it would soon be manufactured in great abundance and at a cheap rate. As it was less liable to tarnish, or to be acted upon and corroded by other substances, than iron, copper, or even silver, it would, as well for this reason as on account of its lightness, tenacity, and beautiful silvery color, be likely to come into extensive use in the arts, and especially for culinary utensils, as soon as a sufficiently cheap method of obtaining it should be perfected.

Prof. Litton exhibited also specimens of the mineral, *Cryolite*, from which Rosa has lately obtained this metal in small quantities.

Mr. Leopold Gast presented a copy of an "Arithmetic" by Adam Riesn, printed in Germany, in 1574.

The following gentlemen were elected officers of the Academy for the year 1857:

President,	Benj. F. Shumard, M.D.
1st Vice President,	A. Wislizenus, M.D.
2d Vice President,	Chas. P. Chouteau, Esq.
Corresponding Secretary,	Nathaniel Holmes, Esq.
Recording Secretary,	J. S. B. Alleyne, M.D.
Treasurer,	Simon Pollak, M.D.

Curators,	B. F. Shumard, M.D. Dr. A. C. Koch. John Lebrecht, M.D. Chas. W. Stevens, M.D.
Librarian,	Montrose A. Pallen, M.D.

The chairmen of the several standing committees were appointed by the President, as follows:

On *Ethnology,*	Dr. A. Wislizenus.
" *Comparative Anatomy,*	Prof. C. A. Pope.
" *Mammalogy,*	Prof. C. W. Stevens.
" *Ornithology,*	Mr. Edward Wyman.
" *Herpetology and Ichthyology,*	Prof. M. M. Pallen.
" *Chemical Geology and Malacology,*	Dr. H. A. Prout.
" *Entomology,*	Prof. W. M. McPheeters.
" *Botany,*	Dr. T. C. Hilgard.
" *Palæontology and Geology,*	Dr. B. F. Shumard.
" *Mineralogy,*	Mr. John Moss.
" *Chemistry,*	Prof. A. Litton.
" *Physics,*	Mr. James B. Eads.
" *Embryology,*	Dr. E. H. Gregory.
" *Monstrosities,*	Dr. J. S. B. Alleyne.
" *Library,*	Dr. Geo. Engelmann.
" *Publication,*	Prof. W. M. McPheeters.

Amadée Berthold, Esq., was elected an Associate Member.

January 26, 1857.

The President, Dr. B. F. Shumard, in the chair.

Letters were read from Dr. Kirtly Ryland, of St. Clair Co., Ills., Dr. Geo. Steele, of Austin, Texas, Warwick Hough, Esq., of Jefferson City, and Lieut. F. T. Bryan, U. S. A., elected Corresponding Members.

The committee to whom was referred the Paper read by Dr. T. C. Hilgard, on Phyllotaxis, reported the same for publication in the Transactions.

Dr. A. C. Koch read a Paper on Mastodon Remains in the State of Missouri, which was referred to a committee, consisting of Mr. Holmes, Dr. Pallen, and Dr. Pope.

Dr. A. Wislizenus read a Paper on ancient Indian graves, discovered by him, near Prairie du Rocher and Kaskaskia, in the State of Illinois.

Mr. Spencer Smith remarked that similar graves had been discovered on the bluffs of the Illinois River, in Greene county.

The Paper was referred to a committee, consisting of Drs. Prout, Stevens and Watters.

Prof G. C. Swallow presented a copy of his Third Report of Geological Survey of Missouri.

The following gentlemen were appointed on the several standing committees, by the respective chairmen:

On Comparative Anatomy,	Dr. A. C. Koch.
" *Entomology,*	" F. E. Baumgarten.
" *Mammalogy,*	Prof. J. T. Hodgen.
" *Palæontology and Geology,*	Dr. H. A. Prout.
" *Ethnology,*	Mr. N. Holmes.
" *Botany,*	Dr. John Lebrecht.
" *Monstrosities,*	" M. A. Pallen.
" *Chemical Geology and Malacology,*	" A. Wislizenus, " S. Pollak.

George G. Shumard, M.D., was elected a Corresponding Member, and Uriel Wright, Esq., Dr. John R. Washington, and Mr. Wm. Maffit, were elected Associate Members.

February 9, 1857.

The President, Dr. B. F. Shumard, in the chair.

A letter was read from Dr. B. B. Brown, of Sacramento, Cal., elected a Corresponding Member.

On motion, ordered that an edition of one thousand copies of the first number of the Transactions be printed, under the direction of the Committee on Publication.

Dr. Wm. M. McPheeters presented a tusk of the walrus, some carved figures from the Fejee Islands, and an interesting suite of shells, corals, and lava, from the South Pacific.

Mr. John Moss presented specimens of sulphuret of iron, and sulphuret and carbonate of lead.

Dr. B. F. Shumard read a Paper, entitled "Description of New

Species of Fossil Crinoidea, from the Palæozoic Rocks of the Western and Southern portions of the United States," illustrated with Plates. Ordered to be printed in the Transactions.

Prof. G. C. Swallow stated that, during the last season, he had discovered and opened, with the assistance of the people of the neighborhood, several ancient Indian mounds, in the county of New Madrid, in the southeastern part of the State. The mounds were situated in a plain or wide basin, (not a river bottom,) and their bases rested on a layer of sand five feet below the surface of the ground; and old forest trees were growing over them as upon the surrounding plain. The largest mound was 900 feet in circumference at the base, and 25 feet in height; and there were other smaller mounds in the immediate neighborhood. Several of them were opened by sections from top to bottom. In most of them were found various articles of earthen pottery, pipes, and bones of quadrupeds and fish, together with small portions of human bones, and some whole teeth. In the upper part of the larger mound, the plough, in making the excavation, struck the bottom of a sun-baked earthen jar or pot, about ten inches in diameter, lying bottom upwards. On taking it up, the top portion of a human skull was seen inside, laying across the mouth of the jar, with the convex side downward. The mouth of the jar was five inches in diameter; but the piece of skull was much too large to pass through the opening, and could not be got out without breaking it to pieces. How it got in, was a question which he would leave to others to solve. This was the only bone in the jar, except a single vertebra. No implements of war were found in any of these mounds; every thing discovered in them indicated peaceful habits. Traces of decayed human skeletons were visible in the smaller mounds, and the articles of pottery appeared as if they had been placed at the head of the buried body. No skeleton, or skull, remained entire. He had caused accurate measurements and drawings to be made, which would be given to the public in the Geological Report. The mounds previously found in Howard county, Mo., in which he had discovered a human skeleton buried in a sitting posture, together with implements of war, he considered as belonging to a comparatively modern period; but these of Southeastern Missouri must be admitted to be of very ancient date, as was evident not only by the growth of old trees upon them, but by the character of the pottery, the condition of the remains, and the depth of alluvial strata which have been deposited around their bases since they were constructed.

Dr. J. B. Johnson observed that savage races were known to have used a portion of the skull as a drinking cup; but that bone, neither in a fresh state, nor when boiled in water, would bend, or yield, to much compression, without fracture.

Dr. M. A. Pallen remarked that bone, in some diseased conditions, became more or less pliable; but here was no evidence of such a condition. He concurred in the suggestion that the jar must have been moulded over the skull, and then dried in the sun.

The committee to whom was referred the Paper read by Dr. A. C. Koch, on Mastodon Remains, recommended the same fo publication in the Transactions.

The Papers read by Dr. J. Schiel, on Glycerin, and by Dr. A. Wislizenus, on Indian Graves, were recommended for publication in the Transactions.

It was also ordered, that the Paper prepared by Prof. A. Litton, on Belcher's Artesian Well, be published in the Transactions.

Dr. M. A. Pallen, intending to be absent from the city for some time, resigned the office of Librarian. Dr. T. C. Hilgard was elected to fill the vacancy.

On motion, it was voted to accept the Charter of Incorporation of the "Academy of Science of St. Louis," granted by the General Assembly of the State of Missouri, at its late session.

I. *On some* New Species *of* Fossils *from the Cretaceous Formation of Nebraska Territory.* *By* John Evans, M.D., *and* B. F. Shumard, M.D.

ACEPHALA.

Avicula Nebrascana.

Shell compressed, thin; cardinal margin straight, rather wide; buccal margin rounded, retreating; anal edge long, concave above and arched below; posterior wing triangular, very slightly concave, pointed; anterior wing small; umbo convex, not gibbous; beak small, projecting very slightly above the cardinal edge; surface marked with radiating, thread-like, simple striæ. At four lines from the beak, there are about eight of these striæ in the space of two lines; towards the palleal border the number is increased by implantation; the interspaces are about double the width of the striæ, and are marked with very fine longitudinal lines. With the aid of a lens, very fine, closely arranged, waved lines of growth are perceptible.

Occurs in the Cretaceous Formation, near Moreau River, Nebraska Territory.

Limopsis striato-punctatus.

Shell small, ovate, subquadrate, usually transverse, moderately gibbous, subangular behind, rounded before and below, posterior margin oblique, slightly arcuate; umbones rather prominent, a very shallow depression behind; beaks moderately prominent, extending above the cardinal margin, and situated nearest the anterior extremity; substance of the shell moderately thick; hinge with strongly set teeth; surface ornamented with fine concentric lines of growth, crossed by fine, longitudinal, flexuous striæ, which are minutely punctate at the points of intersection.

Dimensions.—Length, 5 lines; height, about 4 lines; thickness, about 3 lines.

Localities.—Moreau and Grand Rivers, Nebraska Territory.

This is a very neat, pretty species. It occurs in the greatest profusion—layers nearly a foot in thickness being sometimes almost wholly made up of them.

Cardium subquadratum.

Shell small, subquadrangular, length greater than the height, gibbous; anterior margin rounded, posterior margin truncated; very slightly arched; umbones prominent, large, obtusely subangulated; beaks nearly medial, rather obtuse, and extending but little beyond the cardinal margin; substance of the shell thin;

surface with fine concentric striæ of growth, waved and dentate posteriorly, where they are crossed by obscure longitudinal ribs.

Dimensions.—Length, $5\frac{1}{2}$ lines; height, $4\frac{3}{4}$ lines; thickness, nearly 4 lines.

Locality.—Moreau River. Very abundant.

CARDIUM RARUM.

Shell small, ovate, subquadrate, moderately gibbous, inequilateral, substance very thin, length and breadth nearly equal; cardinal edge short, somewhat sharp; beaks projecting above the cardinal margin, nearly medial, rather blunt, incurved; umbo oblique, somewhat gibbous, subangulated behind; posterior slope falling abruptly to the anal margin; buccal and palleal margins rounded; anal margin obliquely subtruncate; surface polished, and marked with very fine, closely arranged, concentric lines, crossed on the posterior side by nearly obsolete longitudinal ribs, becoming more prominent as they reach the border, which on this part of the shell is finely crenulated.

This species in its general form resembles *Cardium subquadratum*, from which it may be distinguished by its smaller size, polished surface, and the extreme thinness of the valves. The longitudinal ribs on the posterior side are also nearly obsolete, and the beaks more prominent.

Total length, $4\frac{3}{4}$ lines; width, 4 lines; thickness, 3 lines.

Localities.—It is associated with *Limopsis striato-punctatus* on Moreau and Grand Rivers.

ARCA SULCATINA.

Shell small, sub-rhomboid, length almost double the height; beaks situated in advance of the middle, rather prominent, incurved, distant; umbones oblique, angulated posteriorly, moderately convex, having a distinct sulcus, which passes obliquely from the beak to the palleal margin, cutting the latter about the middle of the shell, sulcus most deeply impressed on the right valve; buccal margin short, forming nearly a right angle with the cardinal edge; anal margin obliquely truncated; ligamentary area rather large, elongate-ovate; surface with from 18 to 20 radiating striæ, with accessory ones in the intervals.

Length, 4 lines; height, rather more than 2 lines; thickness, $1\frac{2}{3}$ lines.

All the specimens of this species in our collection are internal casts.

Locality.—It was found with the preceding species on Wood's Fork, 3 miles from Grand River.

LEDA FIBROSA.

Shell inequivalve, inequilaterate, ovate, subtriquetral, very gib-

Curators,	B. F. Shumard, M.D. Dr. A. C. Koch. John Lebrecht, M.D. Chas. W. Stevens, M.D.
Librarian,	Montrose A. Pallen, M.D.

The chairmen of the several standing committees were appointed by the President, as follows:

On Ethnology,	Dr. A. Wislizenus.
" *Comparative Anatomy,*	Prof. C. A. Pope.
" *Mammalogy,*	Prof. C. W. Stevens.
" *Ornithology,*	Mr. Edward Wyman.
" *Herpetology and Ichthyology,*	Prof. M. M. Pallen.
" *Chemical Geology and Malacology,*	Dr. H. A. Prout.
" *Entomology,*	Prof. W. M. McPheeters.
" *Botany,*	Dr. T. C. Hilgard.
" *Palæontology and Geology,*	Dr. B. F. Shumard.
" *Mineralogy,*	Mr. John Moss.
" *Chemistry,*	Prof. A. Litton.
" *Physics,*	Mr. James B. Eads.
" *Embryology,*	Dr. E. H. Gregory.
" *Monstrosities,*	Dr. J. S. B. Alleyne.
" *Library,*	Dr. Geo. Engelmann.
" *Publication,*	Prof. W. M. McPheeters.

Amadée Berthold, Esq., was elected an Associate Member.

January 26, 1857.

The President, Dr. B. F. Shumard, in the chair.

Letters were read from Dr. Kirtly Ryland, of St. Clair Co., Ills., Dr. Geo. Steele, of Austin, Texas, Warwick Hough, Esq., of Jefferson City, and Lieut. F. T. Bryan, U. S. A., elected Corresponding Members.

The committee to whom was referred the Paper read by Dr. T. C. Hilgard, on Phyllotaxis, reported the same for publication in the Transactions.

Dr. A. C. Koch read a Paper on Mastodon Remains in the State of Missouri, which was referred to a committee, consisting of Mr. Holmes, Dr. Pallen, and Dr. Pope.

Dr. A. Wislizenus read a Paper on ancient Indian graves, discovered by him, near Prairie du Rocher and Kaskaskia, in the State of Illinois.

are about twelve on the second volution, spaces distinctly impressed; lines and spaces crossed by fine striæ and moderately distinct folds; lip rather strongly arched, and deeply emarginate above.

Length, 6 or 7 lines; width, $2\frac{1}{3}$ lines; length of aperture, 3 lines.

Locality.—Moreau and Grand Rivers.

Fusus Haydeni.

Shell large, elongate-fusiform, spiral angle about 26°; volutions about seven, convex; body volution occupying two-thirds the entire length; surface ornamented with numerous revolving lines, which are wider than the spaces—these again are traversed by longitudinal lines, which give to the surface a cancellated, subgranulose appearance; lip somewhat sinuous; aperture narrow, angulated behind.

Length, $2\frac{9}{10}$ inches; length of body whorl, $1\frac{8}{10}$ inches; width, 9 lines.

Occurs with *Cardium subquadratum* on Moreau River.

Dedicated to Dr. F. V. Hayden, to whom we are indebted for a very perfect specimen of the species.

Fusus Nebrascensis.

Shell elongate, subfusiform, slender, spire elevated, spiral angle 13° or 14°; volutions flattened, convex (number unknown); aperture slightly oblique, subelliptical, angulated above; suture distinct. Of this species we have only found the body and succeeding whorl. On a part not exfoliated, distinct longitudinal folds are to be seen; other surface markings obliterated.

Length of body and next whorl, about 7 lines; width, 3 lines.

Locality.—Sage Creek, Mauvaises Terres.

Turritella multilineata.

Shell elongate, conic, spire much elevated, opening of spiral angle 19°; whorls about 14, flattened; the last one angulated and gently convex beneath; surface ornamented with distinct, rounded, revolving, unequal lines, crossed by longitudinal arched lines, so as to give to the surface an elegant granulose appearance; suture linear, not very distinct; aperture short, subquadrangular.

Length, about 16 lines; thickness, 5 lines; length and width of aperture, 2 lines.

This is one of the prettiest shells that I have seen from the Cretaceous rocks of Nebraska. The granulæ are arranged in regular revolving lines over the surface, being most prominent on the upper volutions. Usually, we can count about ten revolving lines on the body whorl.

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bous, produced and abruptly attenuated posteriorly, the extremity truncate; umbones prominent, incurved, that of the right valve situated in advance of the other; surface polished, and marked with numerous, closely arranged, fibrous, concentric striæ.

Length, 4¼ lines; height, 3¼ lines; thickness, 2¾ lines.

Locality.—In the septaria of the Cretaceous Formation, of Sage Creek, Nebraska Territory.

Mytilus Meekii.

Shell ovate, subquadrate, transverse, height equal to about half the length; cardinal margin slightly arcuate; umbones very oblique, convex; beaks situated near the posterior extremity, rounded, rather obtuse, moderately prominent; buccal margin short, strongly rounded; anal margin expanded and regularly rounded; inferior margin nearly straight; surface with obscure concentric folds, most prominent posteriorly; test very thin.

Length of largest specimen, 9½ lines; height, 5 lines; thickness, 4 lines.

Readily distinguished from *M. Galpinianus* (*Evans & Shumard*) by its smaller size, the greater gibbosity of the beaks, and its subquadrate form. It can scarcely be confounded with *M. attenuatus* (*Meek & Hayden*), which is a much more slender species.

Locality.—Moreau River.

Ostrea subtrigonalis.

Shell elongate, ovate, subtrigonal, very inequivalve; superior valve flattened convex on the umbo, concave or plane towards the palleal margin; inferior valve convex; umbo strongly subangulated, declining rapidly to the lateral edges, and rounded towards the palleal margin; beak elongated, acute, slightly arched laterally, scarcely incurved; surface presenting some imbricating, concentric lines of growth, and on some specimens a few indistinct radiating costæ.

This shell is very variable in its form, scarcely any two specimens that we have seen being alike.

Locality.—It occurs in greenish-gray calcareo-siliceous sandstone, at a butte in the vicinity of Owl Butte, between Moreau and Grand Rivers. It occupies a higher geological position than the preceding species.

GASTEROPODA.

Pleurotoma minor.

Shell small, fusiform, spire elevated, spiral angle about 31°; whorls seven or eight, convex; body whorl equal to one-half the entire length; surface with distinct revolving lines, of which there

EXPLANATION OF PLATE II.

Fig. 1. Front view of *Productus marginicinctus*.

" 2. Side view of same.

" 3. Lower valve, with its perforation.

" 4, 5, 6 & 7. Different stages of growth.

" 8. Magnified view of the hinge articulation.

" 9. Diagram to show the direction of the spine.

" 10, 11, 12, 13, 14 & 17. Different views obtained of the articulation of the hinge by grinding (magnified several times).

" 15 & 16. Diagram showing the arrangement of the minute vessels upon the upper surface of the ventral valve.

Locality.—Moreau and Grand Rivers.

ROSTELLARIA AMERICANA.

Shell elongate-conic, spire elevated; spiral angle 30°; body whorl obtusely angulated, and bearing two distinct carinæ, which diverge as they approach the outer lip, and become nearly obsolete before reaching entirely around the volution; upper carina most prominent, and rendered subnodulose by longitudinal, moderately prominent, double-arched folds; surface with distinct revolving striæ, of which there are about five in the space between the two carinæ; striæ below the carinæ rather sharper than those above; aperture elongate subtriangular.

Length of last volution, $6\frac{1}{2}$ lines; width, $5\frac{1}{2}$ lines (not including the prolongations of the lip, which are broken off); length of aperture, $4\frac{1}{2}$ lines.

Locality.—Moreau and Grand Rivers.

CEPHALOPODA.

AMMONITES GALPINI.

Shell long, discoidal, whorls (number unknown) slightly embracing, transverse section ovate-subquadrate; dorsum with a prominent narrow keel, on each side of which is a well defined smooth channel wider than the keel; sides with strong prominent subangular ribs, which arise from near the umbilicus, and, proceeding obliquely across the volution, terminate on the outer edge of the dorsal channels; ribs furnished with two prominent nodes, one situated at or near each extremity—those nearest the dorsum most prominent and subtrigonal—the other flattened in the direction of the ribs; lobation of chambers unknown.

The above description is founded on about one-third of a volution of apparently an adult specimen. The ribs vary considerably in number at different periods of growth. In young examples, some are simple, some dichotomous, and others trichotomous, and the intermediate spaces are shallow and narrow; while in adult specimens they are always simple, nearly equidistant, and the spaces are wide and deeply impressed.

Dimensions.—Height of last volution, $2\frac{5}{10}$ inches; width of same, $2\frac{2}{10}$ inches.

This fine species was obtained by Charles Galpin, Esq., of the American Fur Company, on the Cheyenne River, 100 miles above its confluence, and by him presented to the Academy of Science of St. Louis.

II. *Description of a New Species of* PRODUCTUS, *from the Carboniferous Limestone of St. Louis.* By HIRAM A. PROUT, M.D. (*Plate II.*)

FAMILY, PRODUCTIDÆ. (Davidson.)

GENUS, PRODUCTUS. (Sowerby.)

Group, Semireticulati. (De Koninck.)

PRODUCTUS MARGINICINCTUS (*nob.*)

Shell of medium size, subquadrate, slightly transverse in full grown specimens, as broad as long in those of middle age. *Dorsal valve* vaulted, with the arch slightly inclining towards the beak and flattened near the anterior border; sinuated, sinus shallow, broad and nearly obsolete at the basal margin; longitudinal ribs round, salient, and tuberculated from the intersection of concentric ridges on the visceral disk; they are seldom dichotomous, and swell in a somewhat alternate manner, in nearly concentric rows, into long tubercles, which, at their lower termini, gave origin to long and slender spines; this arrangement of the tubercles resembles that so beautifully displayed alike on the surface of the *P. subquadratus* and the *P. Cancrini;* neck slightly tapering into a sharp beak rather strongly recurved, terminating a little below the hinge line, upon which it is closely pressed. Auricular expansions shorter than the width of the shell, elevated at the outer angle, much depressed near the beak; hinge line straight; slightly granular on the inner but smooth on the outer border; area obsolete; deltidium none. This valve terminates below in a large and prominent border, or ring, separated from the main body of the shell by a shallow groove, not entirely interrupting the continuity of the longitudinal ribs, which terminate upon the ring, and give it, on its lower surface, a crenulated appearance. This ring terminates in the angles of the cardinal border, and seems to have given origin to many long and delicate spines, and it is probable that the longitudinal ribs were extended into long spines from its lower margin. The concentric ridges are not so large as the longitudinal ribs, except on the auricular expansions on and near the neck, where they are much coarser, and give a wrinkled appearance to the flanks; they are nearly obsolete on the anterior surface of the shell. This valve had many very long and delicate spines distributed irregularly, but somewhat alternately, over its entire surface: they were hollow, communicated by a perforation with the interior of the shell, and a long, black, horny, hair-like filament was found on the upper side of one or two, probably composed of periosticum. In a mesial section, the spines seem to have grown perpendicularly tangential to the curvature of the shell. Length, about ten lines; width, one inch; eight lines from the beak, the space of two lines gives six ribs.

Locality.—Moreau and Grand Rivers.

Rostellaria Americana.

Shell elongate-conic, spire elevated; spiral angle 30°; body whorl obtusely angulated, and bearing two distinct carinæ, which diverge as they approach the outer lip, and become nearly obsolete before reaching entirely around the volution; upper carina most prominent, and rendered subnodulose by longitudinal, moderately prominent, double-arched folds; surface with distinct revolving striæ, of which there are about five in the space between the two carinæ; striæ below the carinæ rather sharper than those above; aperture elongate subtriangular.

Length of last volution, 6½ lines; width, 5½ lines (not including the prolongations of the lip, which are broken off); length of aperture, 4½ lines.

Locality.—Moreau and Grand Rivers.

CEPHALOPODA.

Ammonites Galpini.

Shell long, discoidal, whorls (number unknown) slightly embracing, transverse section ovate-subquadrate; dorsum with a prominent narrow keel, on each side of which is a well defined smooth channel wider than the keel; sides with strong prominent subangular ribs, which arise from near the umbilicus, and, proceeding obliquely across the volution, terminate on the outer edge of the dorsal channels; ribs furnished with two prominent nodes, one situated at or near each extremity—those nearest the dorsum most prominent and subtrigonal—the other flattened in the direction of the ribs; lobation of chambers unknown.

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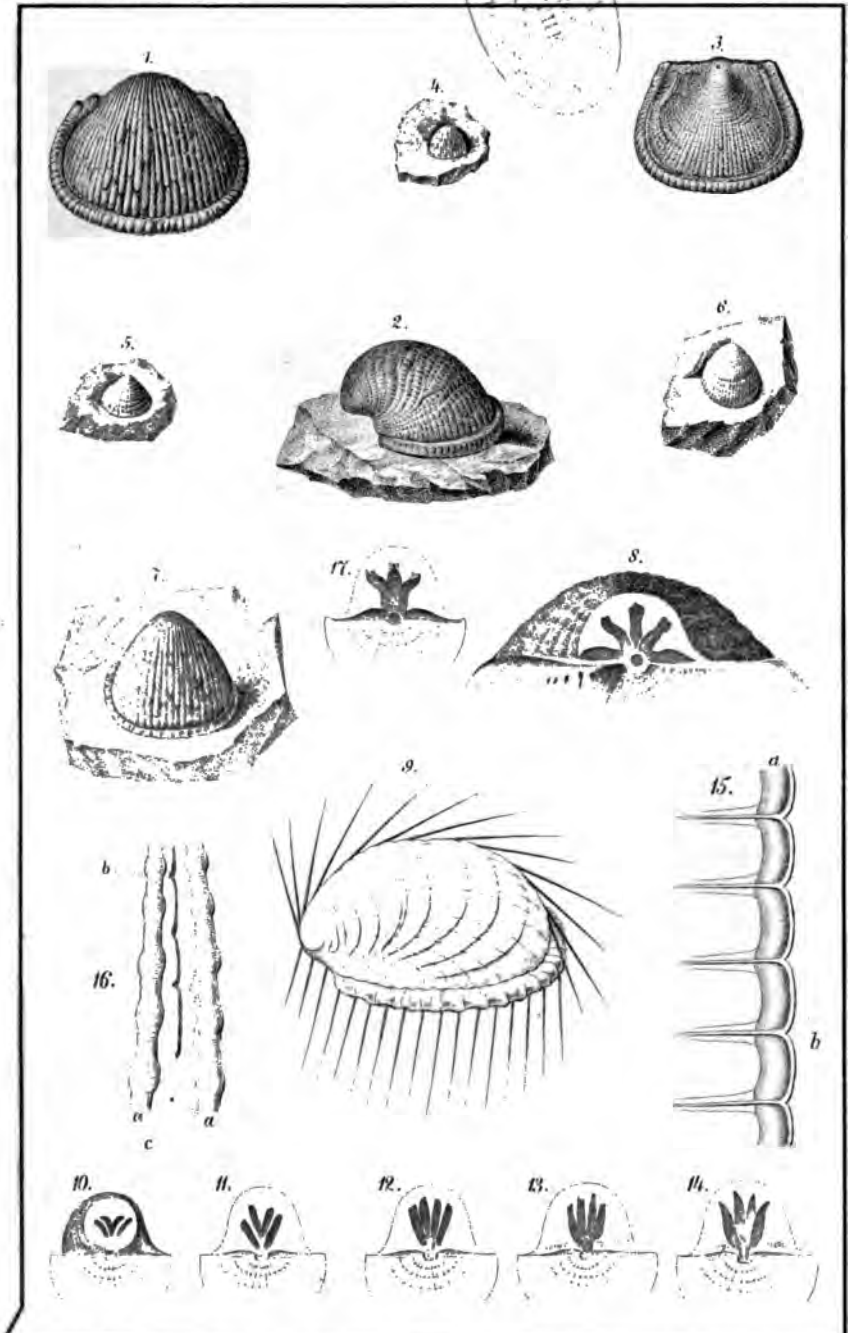
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E[illegible]PLA[illegible]N O[illegible] PLATE [illegible].

[illegible] view of [illegible] *marginat[illegible]*

[illegible] Side view of [illegible].

[illegible], with its [illegible].

[illegible] & 7. Different stages of [illegible].

Magnified view of the hinge [illegible]

Diagram to show the direction of the spine.

[illegible]1, 12. [illegible]3, 14 & 17. [illegible] views obtained of the [illegible] the hinge by grinding (magnified several [illegible]

[illegible] & 16. Diagram showing the arrangement of the minute [illegible] the upper surface of the ventral valve.

EXPLANATION OF PLATE II.

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Group, Semireticulati. (De Koninck.)

PRODUCTUS MARGINICINCTUS (*nob.*)

Shell of medium size, subquadrate, slightly transverse in full grown specimens, as broad as long in those of middle age. *Dorsal valve* vaulted, with the arch slightly inclining towards the beak and flattened near the anterior border; sinuated, sinus shallow, broad and nearly obsolete at the basal margin; longitudinal ribs round, salient, and tuberculated from the intersection of concentric ridges on the visceral disk; they are seldom dichotomous, and swell in a somewhat alternate manner, in nearly concentric rows, into long tubercles, which, at their lower termini, gave origin to long and slender spines; this arrangement of the tubercles resembles that so beautifully displayed alike on the surface of the *P. subquadratus* and the *P. Cancrini*; neck slightly tapering into a sharp beak rather strongly recurved, terminating a little below the hinge line, upon which it is closely pressed. Auricular expansions shorter than the width of the shell, elevated at the outer angle, much depressed near the beak; hinge line straight; slightly granular on the inner but smooth on the outer border; area obsolete; deltidium none. This valve terminates below in a large and prominent border, or ring, separated from the main body of the shell by a shallow groove, not entirely interrupting the continuity of the longitudinal ribs, which terminate upon the ring, and give it, on its lower surface, a crenulated appearance. This ring terminates in the angles of the cardinal border, and seems to have given origin to many long and delicate spines, and it is probable that the longitudinal ribs were extended into long spines from its lower margin. The concentric ridges are not so large as the longitudinal ribs, except on the auricular expansions on and near the neck, where they are much coarser, and give a wrinkled appearance to the flanks; they are nearly obsolete on the anterior surface of the shell. This valve had many very long and delicate spines distributed irregularly, but somewhat alternately, over its entire surface: they were hollow, communicated by a perforation with the interior of the shell, and a long, black, horny, hair-like filament was found on the upper side of one or two, probably composed of periosticum. In a mesial section, the spines seem to have grown perpendicularly tangential to the curvature of the shell. Length, about ten lines; width, one inch; eight lines from the beak, the space of two lines gives six ribs.

Ventral valve subquadrate, irregularly concave following the concavity of the dorsal valve, anterior border much thickened where it meets the curvature of the other valve; on its dorsal face, the longitudinal ribs radiate from a perforated point nearly opposite the umbo, and are crossed by irregularly branching, coarse, concentric ridges, which give to this surface a beautiful reticulate aspect; it is further marked by a slight, broad and triangular *bourelet*, slightly depressed in the middle by a very shallow sinus, which is also triangular in form, widening much as it proceeds from the perforated point to the anterior border. This sinus and the depressions which occur between the outer borders of the bourelet and the cardinal angles give place to three depressions on this surface of the valve; the bourelet with its middle sinus occupies nearly the whole of the visceral disk. Spine holes are found here and there in the depressions between the longitudinal ribs and the concentric ridges, arranged nearly alternately, or quidcuncially, as upon the dorsal valve: a little beyond the perforated point, the hinge line is thickened into a small tubercle, bisected by a triangular depression giving rise to two points, which correspond to similar points on the hinge line of the dorsal valve. The structure of the articulation of the valves, apart from the hinge lines, was determined only after much patient and careful investigation, and, although not as fully defined as could be desired from the limited number of specimens before me, will, I believe, be found to present the following arrangement: the hinge line of the dorsal valve projects as a thin, flat, corneous layer for several lines towards the centre of the shell, before it terminates in an attenuated edge; it is perforated near its middle by a tube which transmits the ligament from the perforated point of the ventral valve; this tube, extending forward and upward, expands like the petals of a tulip into five petaloid cavities, which are designed to receive the corresponding divisions of the ligament, by which greater strength was secured to the ligament in its attachment. In Fig. 8, two of these petaloid expansions are seen resting on the plate, from the oblique manner in which they are ground; three others are seen standing nearly erect. In Fig. 14, four petaloid processes and the central tube for the passage of the ligament are observed, two depressed petaloid processes having apparently disappeared from the grinding of the surface. The space in front being marked by the remains of the two lateral petaloid processes, and the axis of the ligament having been reached in this specimen, I am induced to believe that there were five petaloid expansions; the appearance of four points is due to the grinding in two of one of the hollow tubes. On the dorsal surface of two ventral valves, we observed minute hair-like threads, which seemed to originate in the openings for the spines near the perforated point, and to run continuously, or interruptedly, between the longitudinal ribs, towards the circumference of the shell; they seemed to dip separately into each spine opening, and to emerge, again, to dip into the next, to emerge in the same manner: it is probable that these vessels coalesced and formed a lining for the spines, for the better circulation of the water. Their arrangement is exhibited in diagrams Nos. 15 and 16. The lower surface of the ventral valve is characterized by the same beautifully reticulated appearance as the upper; the whole surface, except the cardinal border, was covered with spines. No traces of hepatic, or muscular, impressions were found, unless a semilunar depression found on the ventral aspect of the dorsal valve, near the umbo, in two specimens, may be regarded as such.

Comparisons and Differences.—In general form, this species resembles somewhat the *P. Altonensis* of Drs. Norwood and Pratten, but, independently of its belonging to a different group, (the *semireticulati*,) it possesses the marginal ring and other characters which sufficiently distinguish it from this and all other species except the *P. marginalis* of De Koninck, from which it is separated by its well marked sinus, the saliency of its ribs on the whole visceral disk, by the greater number of its tubercles and their nearly regular distribution in concentric rows, by the perforated bourelet of the dorsal surface of the ventral valve, and by several other minor distinctions, which show that, though allied to the *marginalis* in its cingulum, it differs more than specifically in many other important points.

This shell resembles in some respects the *P. splendens* of Norwood & Pratten, but differs in being less transverse, in the shortness and evenness of its hinge line, in the absence of the two tubes on the auricular expansions, the greater distinctness of the concentric furrows on the visceral disk, the less pronounced depth of the dorsal sinus, and the distinct terminal ring at the base of the dorsal valve. The ventral valve of the *P. splendens* has a cingulum, which, together with other characters, sufficiently distinguishes it from the corresponding valve of the *marginicinctus*.

Geological Position and Locality.—Found in thinly stratified beds of argillaceous limestone, forming the upper series of the Carboniferous Limestone in the suburbs of the city of St. Louis, associated with the *Productus cora*.

IIII. *Observations on Glycerin.* By James Schiel, M.D.

Of all substances known in organic Chemistry, there is hardly one which has, in our day, attracted more the general attention than Glycerin; discovered in 1779 by Scheele, a century has nearly elapsed before the properties of this remarkable substance were fully recognized and appreciated.

Scheele considered it as a kind of sugar, and after him it has long been called oil-sugar, or the sweet principle of oils; later it was viewed by chemists as a substance whose constitution w analogous to that of alcohol; but neither the composition, the chemical behavior, nor the physical properties of it, speak in favor of this view, which still seems to be adhered to by some chemists.

In the June number, 1842, of "The Annals of Liebig & Wohler," I published a paper, in which I showed that the substances which might be called by the generic name "Alcohols," formed a regularly progressive series; so that if by R we designate the hydro-carbon (C_2 H_2), we have

			Boiling point, C.
R_1	HO+HO	Methylic alcohol,	60
R_2	HO+HO	Vinic "	78.4=60+18
R_3	HO_5+HO	Glycerin.	
R_4	HO+HO	(?) Unknown.	
R_5	HO+HO	Amylic alcohol, (Fusel oil.)	132=60+4+18
:	:	:	
:	:	:	
R_{16}	HO+HO	Hydrated oxyde of ethyl.	
:	:	:	
:	:	:	
R_{24}	HO+HO	" " cerosyl.	

It was shown that the boiling point of each substance entering this series was 18° C higher for every R (C_2 H_2), a regularity which had been previously proved by H. Kopp to exist between alcohol and methylic alcohol, and their compounds, but not farther; the general formula of alcohols was accordingly given as R_n 2 HO or R_n HO+HO, and glyeerin with the formula R_3 HO_5 + HO, and a boiling point far above 60+2×18, must therefore be left out of the series as not belonging to the alcohols; its place belongs to propylic alcohol. (Several members of the above series, then unknown and marked by dots, have since been discovered.)

The article on this series, which was the first progressive series ever published in organic chemistry at that time, closed with these words: "There are undoubtedly other similar series in organic chemistry, and I hope in a short time to revert to this subject." From this I was prevented by occupations of a different character; but, three months after, M. Dumas laid before the *Academie des Sciences* his series of fatty acids, fully confirming, by this, my opinion.

According to Chevreuil and other chemists, the pure glycerin is entirely without any odor; the sp. gr. was repeatedly found by Pelouze to be 1.27, but, amongst all the articles brought into the market which I examined, none were found to agree with their statements; they all had a highly offensive odor, and mostly a sp. gr. of 1.22. In order to ascertain whether the smelling glycerin was of a different composition, a portion of it was placed in a little retort, which was connected with an air-pump; the receiver, a strong vial, was surrounded with ice; the vacuum was continued for two days: during the first day, the glycerin was not heated above 100° C; the second, it was kept at a temperature of not above 140° C.

The water collected in the receiver was about one-fifth of the quantity of glycerin used, and possessed all its odor and taste; the remaining glycerin, which possessed a strong odor, had the sp. gr. 1.269; it was a thick, slightly yellow syrup; a portion of it, burnt with oxide of copper and oxygen, showed the composition—

Carbon	38.65
Hydrogen	8.86
Oxygen	52.49
	100.

The composition of glycerin was found by Pelouze—

Carbon	39.03
Hydrogen	8.76
Oxygen	52.21
	100.

According to these numbers, the analyzed glycerin had the normal composition, and if its strong odor belongs to a foreign substance contained in it, the latter is not present in such a quantity as to perceptibly influence the result of the analysis.

The affinity of glycerin for oxygen seems to be very indifferent; a portion of half a gramme was exposed to the action of oxygen in the accompanying little apparatus for three weeks, and not one-eighth of a cubic centimetre was absorbed, although it was exposed to the influence of the sun.

The apparatus mentioned consisted of a glass tube drawn out at both ends, blown up into two bulbs and bent at a right angle between the bulbs. The shape of the apparatus will be best seen from the annexed diagram. A portion of the liquid is drawn in by suction; the point *c* is dipped into quicksilver, contained in a small test tube; the other end is connected with a vessel of pure oxygen, and a current of this is passed through the vessel from five to six seconds, or until a small piece of ignited coal dipping in the test tube burns with a flame; the apparatus is then sealed at the end *a*. This apparatus may be modified in different ways according to the wants of the chemist. I have used it for the last ten years, and have never felt the want of the large pneumatic quicksilver apparatus.

As glycerin is coming more and more into general use, it is desirable to have a cheap source from whence to procure this substance.

In manufacturing stearin candles, the fatty acids are saponified with caustic lime, the stearates, margarates, palmitates, etc., of lime being precipitated, while the glycerin remains in solution in the water. If this water be again used in the saponification of a new portion of fat, the solution becomes more concentrated, so that, by the evaporation of 100 buckets of such water, we would obtain from 12 to 14 gallons of impure concentrated glycerin; it will require to evaporate these 100 buckets 15 bushels of coal.

In the watery solution of glycerin, there is contained much caustic lime, which remains in the concentrated article. It has been proposed by some French chemists, to remove this by the aid of sulphuric acid; but no glycerin treated by this very defective and tedious method is entirely free from lime.

The following method will be found to be by far more simple and more effective:—Into the somewhat concentrated solution of glycerin, throw pieces of carb. ammonia sufficient to thrown down as a carbonate all the caustic lime, stirring constantly while the evaporation proceeds; keep the solution boiling at a temperature of between 140° to 150° C; this is effected by adding a little water when the solution becomes so concentrated as to raise the boiling point higher; in the course of an hour or two, all the the caustic ammonia, as well as the excess of carbonate added, passes off.

The method of clarification discovered by Wilson consists in distilling concentrated glycerin by the application of over-heated steam. He says that glycerin, so obtained, is entirely pure and odorless; but I must confess that I could find no English glycerin in the market free from the offensive odor; nor could I, by following his method, obtain an odorless article. Moreover, it seems that glycerin so obtained contains small portions of acrolein, for a drop of it brought into the eye causes a sharp and painful sensation not produced by pure glycerin; this renders it entirely useless in diseases of the eye, in which pure glycerin has sometimes very beneficial effects, by rubbing it over the eyelids and around the eye.

I have found glycerin very useful when half a teacupful is added to injections in cases of bilious cholic; the vapors of boiling diluted glycerin, when inhaled, will be found to have a soothing effect in catarrhal affections of the lungs.

IV. *Phyllotaxis—its numeric and divergential law explicable under a simple organological idea.* By T. C. Hilgard, M.D. (*Plate III.*)

The phenomena of PHYLLOTAXIS, or *relative disposition of the foliar organs of plants*, have not hitherto been understood beyond the analysis of their relations of NUMBER and DIVERGENCE to their simplest "mathematical expressions" or forms of mensuration. Both *number* and *divergence* refer to the organological fact of the leaves, etc., appearing exclusively *by sets*, in which the leaves, after a fixed numeric law, are so arranged as to severally occupy all the positions apparent within the ambit and but once within the set; which however may be repeated, as is generally the case on the stems, but more rarely in flowers.

The total of foliar parts required before superincumbence (repetition, viz., in the sense of the longitudinal fibre or *split*) takes place, is called a *cycle.*

In a bird's-eye view, the ambit is by the leaves divided into as many interstices as there are leaves to a cycle. The number of leaves, or interstices, in a given cycle, is called the "*cyclar number*" thereof.

The leaves either occur, as they most frequently do, in single-file succession, after a certain law of alternation completing a cycle (e. g., of 8 leaves occupying 8 different positions), of which, when continued after the same plan, the 9th is found superincumbent or correspondent to the first assumed one; or, a number of leaves are placed at equal heights, radiating like the spokes of a wheel, which disposition is called a *whorl* or *verticil*, and either completing a cycle, or, as is mostly the case, a number of alternate whorls are required before the subsequent one becomes duly superincumbent above the first assumed one.

In each of these cases, the number in question—whether of singly disposed leaves to a cycle, or the number of leaves composing a whorl, or of whorls completing a (compound) cycle—is always, with few exceptions, one of these, and no others: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, etc. A series evolved by a rule of adding the two last numbers on hand, but commencing by 1: 1, $(1+1)=2$, $(2+1)=3$, $(3+2)=5$, $(5+3)=8$, $(8+5)=13$, etc.; and the *number of divergence*, or of (*ichnographic*) *interstices* (counting in the shortest direction) *between each two leaves proximate in height*, belongs to the same series, invariably being the one *antepenultimate* in the series *to the cyclar number* in question. Where there are 13 leaves to a cycle, and consequently 13 interstices (in a bird's-eye view) to the ambit, then each two proximate leaves thereof diverge (in the short-way direction) 5 interstices—5 being serially antepenultimate to 13,—or diverge by $\frac{5}{13}$ of a circle, admitting the interstices to be nearly equal; which, however, is irrelevant, as the law of *alternation* only is the point essential. Where there are 8 to a cycle, the mode of disposition is what is called "$\frac{3}{8}$ disposition," leaping, in the short direction, 3 interstices or 2 leaves; if 5, $\frac{2}{5}$ of the circle, or 2 interstices (leaping 1 leaf); and so on consistently.

Exceptionally, there occur other cyclar numbers and rates of divergence, but which form series secondarily derivable from the above series, e. g., by adding two penapproximate numbers.* To prevent all misunderstanding, and to have a general method of expressing whatever divergences, they are universally expressed by a fraction having as denominator the cyclar number, and as numerator the number of interstices leaped in counting short-way from any leaf to the proximate one in height (or along the stalk).

We here only purport to treat of the vastly prevailing, and doubtless the *fundamental*, series and its divergences, irrespective of the rare heteronomous exceptions above indicated.

No sufficient explanation of either the numbers or the divergences, as to their origin from organic processes, or their relations to organic laws, has hitherto been put forth or established.

Foliar Parts,

According to organological considerations, are the scales of buds; the rudiments of leaves, preformed in the bud; the lobes of the seed-embryo, containing in a cavity, or between them, a fine preformation of leaves and stalk; the developed leaves; the leafets (bracts) subtending axillary flower-stalks or branches; the elements of the perigon, calyx, corolla; the individual stamens and capsular elements severally. All organs springing from the axils of leaves or bracts, as branches, buds and "metamorphosed" branches; as the tufts of asparagus, the fir, the tufted warts of Cacti; the ovate-lanceolate leaf-like branches of Ruscus, and likewise the scales of pine cones, both arising from the axils of bracts, and themselves bearing the blossom and fruit: all these, if complete, of course repeat the same order of disposition as the foliar organs from the axils of which they arise.

All foliar parts are originally predeveloped and concealed in the *bud* they constitute, and are arranged in it on a short conical axis, or on a level, or even sometimes a depression. All *stalk* or axial prolongation proceeds after the rudera of leaves are formed; by the agency of which the contingent parts of the stem seem to be produced, each leaf developing unto itself a downward portion of stalk, moving aloft by increasing at the base, as the animal teeth do, of which, if the crown be compared to the foliar rudiment, the root would figure the contingent segment of the axial parts.

Generation in leaves resides at their *base*, or *toward the centre of the stalk* (Schacht).

Geometrical Phenomena.

In a bud—as in the bud (calyx) of the rose, the morning-glory, Mesembryanthemum, and others—the lowest leaf is the largest, and, being the most extrinsic, covers more than any of the rest do. This in No. 1. Compare also the impress-figure of the beet-stubble in our diagram, originally obtained by printing off the object itself. Nearly opposite to it stands the one next in height (on the axis) and size, diverging (in the short direction) $\frac{2}{5}$ of a circle, or, more correctly, leaping 2 interstices. At $\frac{2}{5}$ divergence from it, in the same direction (close to No. 1), stands No. 3, overlapped (covered) on one margin by No. 1. Between Nos. 1 & 2, again, stands No. 4, more reduced in size; and between Nos. 2 and 3 stands No. 5, the narrowest and most oppressed of all.

These elements do not actually stand on equal heights, but they ascend a very little on the axis, and always are at different eccentric distances.

In the *labiate* and *personate* tubular flowers, where sets of 5 are fused into a tube or neck, the *limbi* or marginal expanses frequently, by the succession in which their lobes are found overlapping in the bud (prefloration), still declare the law of *successive position*, and probably of successive development. Of this a very striking example is afforded by the corolla of *Nierembergia filicaulis* (Polemonio-petuniaceæ) of the gardens, where the 5 corners of the rotate *limbus*, by their difference and succession exactly corresponding to a $\frac{2}{5}$ disposition, bespeak the same *successive development* as in the previous examples.

When a number of single-file cycles (successive disposition) are approximated on a comparatively short axis—as on the pine and pine-apple cones, the areolar impressions of the custard-apple, the tubercles on the body and fruit of Cacti, in the disc of the sunflower, on the cupules of acorns and thistles—by a well established mathematical necessity, consequent on the divergential law, certain *bands of parallel spiral files* (coils), comprising all elements, become prominent, *alternating right and left as they succeed in steepness*, and, by the number of coils contained in each different band, *successively rendering the very numbers of the series* in ascending succession: the flattest slope being of a *single* coil; the second in steepness, of a *pair* of coils, and in the opposite sense; the third, of 3; the fourth, of 5 coils; the next of 8—each embracing all elements, and in the opposite sense against the adjacent ones in steepness.

As an example: in the cone of the Norway pine we meet a very prominent flight of 8 steep coils, ascending (i. e., winding) against the sense of watch-hands. The next lower slope or band of coils we find winding *with* the watch-hands, and it embraces 5 files. Next lower, a band of 3 to the right; next, still flatter, a band of 2 to the left; and last and flattest, a single file, verging to the right—each flight embracing all scales. Ascending, we perceive two more systems of files—one of 13, coiling in the opposite sense, and a perpendicular flight of 21 *columns;* from which we conclude that there are 21 scales to the circle, or *cycles of* 21 *scales,* and as many cycles on the cone as there are individual scales contained in each perpendicular column. It is easily seen how the cyclar number can be computed as a serial member, by counting the files of one band or member, and the number of subsequent steepening slopes, including the perpendicular, whose number of files equals the number of (phyllodia, scales or) leaves contained in each cycle.

All this is well known to be the mathematical consequence of the numeral law of divergence, in which the phenomenon has been *reduced to its simplest mathematical expression.*

In the following, it will be our endeavor to construe the active causes which produce that law, by referring it to strictly *corresponding* (and hence probably the *contingent*) organological conceptions generally.

The Numeric Series.

Even the law of divergence being expressed by the instrumentality of *serial numbers*, the *series* seems to be the first point requiring investigation and explanation.

How is it actually organized?

In attempting to suit the character of the series to some organologic (supposed organic) process, the idea of considering each subsequent member merely as the sum of the two preceding seemed less promising, because less in conformity with organic laws, than an idea *involving all the previous members* in that ultimate result.

The idea of a *continued production abreast of all the previous issues*, actively involving all, seemed to throw more light on the *organic* merit of the formula: forthgoing, proceeding, or *procreation on its own merits*, being a distinctive (and probably the fundamental) character of the nature of life; while *persistence in its values of powers* appears to be the property of physical, inert, or mechanical nature, that hence bears no germ for change, or utterance, within itself: the one a *power of progress*, the other of *inertia*. (Compare "Weisungen ueber die mosaische Schœpfungsgeschichte. Wien, bei M. Auer, 1855," §§ 31, 32, 186.) To explain the phenomena of life, the especial character of its powers must be held in view, as elsewhere.

The *genetic* consideration of the mathematical form affords a strict parallel to the actual cause of all living forms: *genesis*, or parturition.

If one cell be supposed (as it is universally observed in microscopic studies on organic development) *to produce another one, and each commences and continues to reproduce, at corresponding terms of maturity, then, at each successive parturition, the successive numbers of the series, and no others, are produced.*

Commence to figure the matter *ab ovo*. At first, each bud represents nothing but a single cell elevated above the tissue. If this one produce No. 2, and also a third one while No. 2 is attaining prolific maturity, we successively obtain 1, 2, 3, cells or foliar rudiments. Why No. 3 should spring up before No. 2 is ready to generate, is plausibly answered by the supposition that the 3d one is owing to the *joint influence* of the mature 1st cell and the maturing 2d cell.

While No. 3 is attaining perfection, both No. 1 and 2 have brought forth each a scion—No. 1 earlier than No. 2. With the 3 adult ones and the 2 new-comers we have 5; the 2 latest whereof maturing, the 3 old ones add a progeny of 3, giving 8; whereof the 3 latest ones attaining perfection, the 5 old ones add a reinforcement of 5 young ones, making 13 in all. We need not go any further.

It is not so probable that each additional set should push at once, but rather that its elements should appear successively, namely, after the rates of pre-extant maturities.

It is known by microscopic observations (Schacht), that in the bud each rudimentary foliar cell springs from a previous one.

The new germs are always produced next to the centre of the axis; by their growth and expansion the older parts remove towards the widening periphery, and younger ones are continually coming up in the centre, as from a fountain of life.

Divergence.

A young and tender part has always a smaller angular space allotted to it than more adult ones, but when itself arrived at a stage of perfection, the angles become apparently equally divided. Hence the point in question is not so much the degree of divergence, but the *order of alternation*, which ultimately produces certain effects of angles.

The next question is, how will the idea of *genealogical origin* of foliar elements—hence of their numbers—apply to the law of *alternations*? and what of organological import can be elicited from the apparent relations between the supposed process and the mathematical form?

If, in a divergential scheme of some high-numbered cycle, the leaves being designated by radii (see the diagrams) marked with the contingent ordinals, all those belonging to the last accrument be struck out, the elements of the penultimate cyclar number, which remains on the field, *follow exactly the same order of alternation as when constructed according to their proper law*, independently of that accrument which had rendered the cyclar number the next higher. In other words, each accrument, in its turn, appears *intercalated between the constituting members of each previous cycle.* This mathematical fact exactly corresponds to the organological supposition, that the lower had existed earlier in time, and were subsequently *increased by accruments into higher cycles.* To a certain degree, this is also established by observation, the second foliar rudiment (cell) springing from the first, thus increasing a cycle of 1 into one of 2 elements.

Each accrument, as a whole, being *inscribed between* the previous members, what relation do its elements severally, or in common, hold to the prior ones?

We find that the elements of the later issues (accruments) stand closely to the side of those prior elements from which our hypothesis supposes them to have sprung.

Moreover, all belonging to the same issue or generation diverge from the supposed parental set in one and the same sense.

Again, each *subsequent* set diverges in the *opposite* sense from its progenitorial one.

Also, if the elements of the accruments be severally inscribed in the order of their ordinals, or *as they succeed in age*, each oldest one of the young set is apposed to the oldest of the parental set, the second to the second, third to third, and so on. Compare the relative position of the white five-rayed star (9, 12, 10, 13, 11, in our diagram) to the dark five-rayed star (1, 4, 2, 5, 3), and the central eight-rayed star to the figure circumscribed by the dotted lines.

We find the former severally dislodged from their respective *elders* in the direction of the movement of watch-hands, the oldest of the young set next to the oldest of the parental set, as above; the second to the second, and so on, correspondingly.

The white eight-rayed star we find dislodged in the *opposite* sense, but invariably the eldest next to the eldest.

This *apposition* loudly pleads in favor of the idea of parentage. To explain why generation should take place, alternately, one side and the other, if once commenced laterally, it is plausible enough that, next in its turn, some generative power might preponderate on the other half, and it would only require a cause that the *first* pullulation should take place *sideward*. We know of no such cause beforehand, and it must stand as a hypothesis until proved or disproved. Next, a cause would be required that such laterally alternate action should always extend on *all the members* of an issue. We know of no such communicated necessity beforehand, and so this is another hypothesis consequent on the idea of essentially a bilateral alternation. Next, something would be required to *individualize* the various "issues" from one another, and we know of no such character to demarcate them within their final cycle; one member continuously succeeding the prior one in size, divergence, and *the sense of divergence*. We have no observations, beforehand, to correspond to the postulates of *laterality*, *solidarity* as to the sense of divergence, and of *diversity* among the issues. Nor do we, beforehand, know of any supposed "spiral," "alternate," or "whorled" agency;—all which must remain *hypothesis* or inferential, instead of conclusive, "*explanation*," until either proven, disproved, or superseded.

If once suggested to the mind, it is easily observed that the same law of sequences, embodying the fact of bilateral alternation, also represents and involves this: that each new-comer stands in the angle *between its supposed parent and the oldest of its immediate neighbors;* No. 14 standing between 1 and 6, rather than between 1 and 9; 15 standing between 2 and 7, 2 being next in turn to produce an offspring, and No. 7 offering more maturity (and probably genetic power) than 10, which stands at the other side of No. 2; and so on, consistently.

Parturition (the cause productive of the series) *depending on maturity*, and the locations of the progeny being directly referable to values of maturity, there can be little doubt that here, as elsewhere, it is *prior maturity that commands prior parturition*, and *the order of disposition is a function of maturescence.*

We see the two ideas—that of *prolificacy*, explicative of the series, and that of *maturity*, explicative of divergence—by their nature so intimately allied among themselves and pervading each other, and both so eminently incorporated with the laws of development, generally, that we can claim these as quite sufficient, and very plausible, to explain both the serial and divergential law of Phyllotaxis.

Whorls.

No doubt, the most perfect of verticillate positions of foliar elements is found in tubular flowers. Among Monocotyledons we have tubulifiorous forms, as Hemerocallis, Funkia, Amaryllis, Iris, Hedychium, Orchids (the tube being here coalesced with the fruit), which, nevertheless, show six elements in a double row= 3×2. Still they are fused into one circle, demonstrating that such fusion can take place among elements of unequal height on the stem, or rather of unequal age and eccentricity within the bud. Of personate tubuliferous flowers, among Dicotyledons, we have spoken above, where the *successive* development is visible in the "prefloration" or disposition of the separate tips in the bud, while in the rotate ones they appear coördinate. All germs are originally produced on the same level, so to say, each part growing unto itself a small share of stem. Microscopical investigation will have to show, whether the leaves of whorls, *originally*, spring up simultaneously, or successively. The latter is by far the most plausible, as it conveys a motive for the *serial numbers* embodied in the whorls, which motive might otherwise be found missing. It would be easy to suppose, that only after a certain number of pullulations, the shooting of a stem was entered upon simultaneously, by some cause yet to be elicited; and, as a postulate, offering a clue to further laws of vegetable organization, inasmuch as it propounds a well-founded "question to Nature."

Cycles.

As to *cycles*, if, dependent on the first cell, subsequent pullulation takes place 4 times, successively, under the influence of each germ, a cycle of 8 leaves is produced. The 4th pullulation completes 8, in number, and, by further production, the position of the influential germ is *repeated;* no further *intercalation* taking place, but henceforth only a *repetition*. This would appear strange, if the idea of *maturity* did not answer for both cases, that of intercalation and repetition; in either case, that position is assumed which commands *the greatest antiquity and space* left. In fact, so soon as intercalation is rendered impossible by organic exigencies—of nutrition, space, etc.—the prolific germs might thrust their last progeny on their own bosom!—which, probably, is the original process, and is realized by the "opposite" disposition (applied face to face—see Bean, in the diagram) of the two solitary *germinal leaves* (cotyledons) of Dicotyledonous vegetables. If not, *fertility was derived from the first cell, and ceases simultaneously.*

Cyclar Numbers.

The lowest occur only in the seeds, namely, 1, 2 & 3. Whenever a single leaf appears on the stalk, as in Pontederia and Parnassia, they are not really sole, but there are other foliar organs, of a scaly nature, at the base of the stalk, completing a higher cycle.

The seed of the lowest vegetables (*Cryptogamæ*) are a single cell, that flies from the parent and grows by pullulation within itself. In the higher Cryptogamæ—namely, in disporous ferns, as Salvinia—one kind of seminal cells acts the fecundating part on the other kind, being an adult mass—a cotyledon, as it were. Next in relationship follow, probably, Ducksmeat (Lemnaceæ), Balanaphoreæ and Rafflesiaceæ, where the seed represents a single cotyledon or seminal mass, which, compared with the cotyledons of higher plants, may be claimed as a cycle of a single seed-leaf. Wherever there is a skin to a seed, it must be considered as a vaginating foliar organ (Oken), probably itself forming a complete cycle of one, and being circumambient, as the bottle-shaped shales (leaves) of the onion. Next in general development follow Cycadeæ, Coniferæ, and Gnetaceæ, *true monocotyledons by their seed*, besides a seed-skin (1), demonstrating one massive seminal leaf (1), in accordance with the commencement of the series 1, 2, etc. Here, the seminal lobe, in an excavation, affords a taper, little preformed stem—otherwise interpreted as a "*radicle coalesced* (sic!) *with the albumen*,"—with a whorl of rudimentary leaves at the tip (as in our figure of the embryo of Pinus Cembra, much resembling that of maize)—and making twice a cycle of 1 leaf, or one of 2, succeeded by a higher-numbered whorl.

In the ruscous (asparaginous) tribe, adjoining these phyllodiaconed tribes, the *sedge-leaf* type—generally called *Monocotyledons*—commences introducing the sedge-leafed and *invaginated* "*plumule*," as in the sarsaparilla, aloë, lily, iris, ginger, banana, orchid, and Tillandsia tribes, and in flowering and glumaceous grasses; in Typhaceæ, aroids, pandans, palms, and the pepper tribe, we find a cylindric homogeneous embryo imbedded in albumen, and, in the latter tribe, already manifesting a *dicotyledonous* structure, or a cycle of two seminal leaves to the seed, which, in all the higher plants, include between them the delicate and rudimentary preformation of the future plant.

In conclusion, we would lay before the botanical public an attempt to establish a natural series, by adhesion to the first principle, viz., catholomorphic affinity, or *thorough resemblance of form*;

a question, to which, during a space of twelve years, we have devoted a chief interest, and for the ultimate results of which, we owe much to the anticipating courtesy of European botanists towards the transatlantic student. Of this series we would give a detailed exposition in a later number. The series once established, it was required to find an expression for the rhythmic re-occurrences of floral *symmerism and eleutheromerism* observable, and also an interpretation (*or form*) for the *recurrences of typical features* generally.

In grouping our series into such natural divisions as all those, who followed the idea of *total constitution*, more or less succeeded in forming, we thought we saw strikingly realized the idea set forth by the late Oken, inasmuch as the five successive whorls of the flower—chalyce (chroa), corolla (glossis), androccium or pollinaries (pneusis), gynœcium or seed-vessel (heuresis, acousis), and seed (focality, oculition)—seemed to be, preponderatingly, the type of the five large subdivisions of Dicotyledonæ here assumed. Also, the medullary Cytembryons seem to develop the phases of the seed—fovilla, nucleus, amnios, plumule, and germination; the fibrous Monocotyledons, the *bud*, by *scales* (pines), *bulbs* (lilies), *leaves* (bananas), and *stalks* (reeds, palms),—*seed*, *scion*, and *flower;* in confirmation of a leading suggestion of his, which he rather failed in realizing; *correct hypothesis*, or "truth-invention," being stronger in him than his objective comprehensions, however extensive.

Actuated by the idea that the recurrences, and almost coincidences, so frequently assumed for serial affinities, might be owing to a *phyllotactic mode of development and interpolation*, we tested various suggestions offering to that end. Each of the three chief heads divided into five files, which, if phyllotactically formed into an astral "$\frac{2}{5}$" configuration, each line—*at or near its phases of epigynism—traversing other typical files*, would not only seem, in the well-known "*pentagram*," to supply a suitable figure for those irresistible affinities, but also a fixed motive for *co-ordinate subdivisions* and *characters of vegetation* (Humboldt) *mutually reflected from ray to ray*, affording grounds for *designation*, likewise, and thus, perchance, bidding fair to serve withal as a "leading star" of the crescive kingdom.

REGNI VEGETABILIS
SERIEI CATHOLOMORPHÆ
PRODROMUS.

(* Affinitas statuenda.)

A.—CYTEMBRYONEÆ.

I. GYROPHYTA s. CYTEMBRYONEÆ. GENESIS.

Textura medullari.

1. FUNGI. GRUMOSÆ. SARCODICÆ.

PHYCOMYCETES: Fermenta,* Mucedines,* Favi,* Uredines,* Spumarieæ. Acromycetes: Lycoperdeæ, Phalleæ, Agariceæ, Morchelleæ, Tremelleæ. Bryo(Spongio)-mycetes: Pezizeæ, Clavarieæ, Actidieæ.*

2. Lichens. Siccæ. Endoplasticæ.

Bryo(Spongio-)lichenes: Graphidinæ, Verrucarieæ, Lecidinæ, Pertusaricæ, Umbilicarieæ. Acrolichenes: Parmelinæ, Peltigereæ. Pterolichenes: Usneinæ, Cladonieæ,* Bæomyceæ,* Calycieæ, Pulverariæ (Chloro-Proto-coccus?)

3. Algæ. Fluxiles. Exsudativæ.

Ptero(Hypho-)phyceæ: Chlorocceæ, Nostochinæ, Hydrodictyoneæ, Conferveæ, Diatomeæ. Acrophyceæ: Vaucheriæ, Florideæ, Fuccæ. Mycetophyceæ: Ectocarpeæ, Coleochæteæ, Batrachospermeæ.*

4. Musci. Spongiosæ. Emphysemiæ.

Mycetobrya*: Characeæ (?) Sphagneæ. Acrobrya: Bryoideæ, Jungermanniaceæ. Lichenobrya: Marchantieæ.*

5. Filices. Contextæ. Fibrillinæ.

Lichenopterides: Lycopodiaceæ, Ophioglosseæ, Schizæaceæ, Osmundeæ, Hymenophylleæ. Acroptirides: Onocleæ, Pteroideæ, Cyatheaceæ, Gleicheniaceæ, Marattiaceæ. Phycopterides: *sporis dielinibus:* Marsileaceæ, Salviniaceæ, Isoëteæ,* (Characeæ?) (Calamites?) *sporis hermaphroditis:* Equisetaceæ.*

B.—PHYLLEMBRYONEÆ.

II. STAUROPHYTA s. MONOCOTYLEDONEÆ. PELESIS.

Textura lintea.

1. Coniferæ s. Peucia.

Phycopeucia:* Lemnaceæ,* Balanophoreæ,* Rafflesiaceæ.* Acropeucia: Cycadeæ,* Cupressinæ, Abietinæ, Taxinæ.* Calamopeucia: Gnetacæ* (Chloranthaceæ?)

2. Iulocauleæ s. Iuli.

Calamiuli,* *epigyn:* Dioscoreæ, Taccaceæ. Acriuli, *hypogyn:* Roxbourghiaceæ,* Parideæ,* *perigyn:* Asparageæ, Convallarieæ (Smilacina,* Tofieldia), Melanthaceæ (Veratrum,* Curculigo) Curculigeæ. Coryphiuli*: Calectasieæ,* Yucceæ, Dracæneæ*.

3. Bulbiferæ s. Liria.

Corypholiria:* Agaveæ, Aloinæ, Phormieæ, Agapantheæ. Acroliria, *hypyogn:* Asphodeleæ, Hyacintheæ (Lachenalia,* Erythronium) Lilieæ (Lilium, *epigyn:** Alstrœmeria) Amaryllideæ, Irideæ, Burmanniaceæ,* Apostasieæ, Orchideæ,* Zingiberaceæ, Cannaceæ, Musaceæ.* Peucoliria: Bromeliaceæ,* Hypoxideæ, *perigyn.*, Hæmodoraceæ.*

4. Gramina s. Calami.

Peucocalami, *hypogyn*:* Astelieæ,* Junceæ, Restiaceæ,* (Apyllantheæ ?) (Eriocauleæ ?) Commelynaceæ,* Xyrideæ,* Philydreæ.* Acrocalami:* Centrolepideæ, Gramineæ, Cyperaceæ.* Iulocalami: Typhaceæ, Acorideæ.

5. Palmæ s. Coryphia.

Julocoryphia: Aroideæ, Pandaneæ. Acrocoryphia: Palmæ. Liriocoryphia:* Piperitæ,* Saururus,* Podostemeæ, Najadeæ, Alismaceæ, Butomaceæ, *epigyn.*, Hydrocharideæ* (conjunctio cum Nympheaceis Balanophoreisque).

III. PLECTOPHYTA s. DICOTYLEDONEÆ. ANTHESIS.

Textura reticulari.

1. Chroanthæ s. Charites.

Pnoo-charites s. Calycanthi, *epi-peri-hypogyn:* Nymphacaceæ, Nelumbiaceæ, Cabombeæ,* Myristicaceæ, Anonaceæ, Magnoliceæ, Illicieæ, *perigyn.*,* Calycantheæ, *epigyn.*,* Eupomatieæ,* Serpentariæ,* (conjunctio cum Passifloreis apetalis), Illigera, Gyrocarpus. Acrocharites s. Cissi, *perigyn:* Monimiaceæ, *hypogyn.*, Laurinæ,* Menispermum,* Schizandraceæ, Berberideæ, Ranunculaceæ (Helleborus),* Sarracenieæ,* Nepenthes,* (Dionæa) Droseraceæ,* Parnassia,* Resedeæ, Oxalideæ,* Violaceæ,* Cisseæ, *epigyn.*, Araliaceæ, Umbelliferæ (Scandix, *perigyn.*, Erodium) Geraniaceæ, Tropæolaceæ* (conjunctio cum Meliantho et Æsculo). Ambro-charites s. Siliquosæ, *hypogyn:* Balsamineæ,* Fumariaceæ, Papaveraceæ, Cruciferæ, Capparideæ,* *epigyn.*, (Bartonia) Loasaceæ.*

2. Glossanthæ s. Myrsinæ.

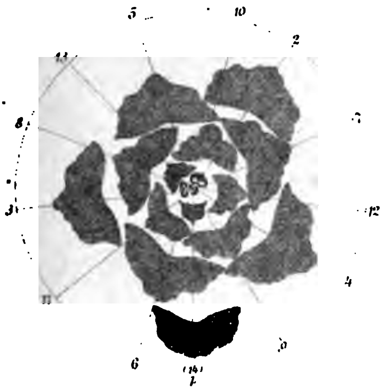
Ambromyrsinæ s. Geniculatæ,* *hypogyn.*, Hypericinæ,* Lineæ,* Armeria, Statice,* Nyctagineæ,* Frankeniaceæ,* Scleranthææ, Diantheæ, Alsineæ (Polycarpon), Mollugineæ,* Elatine, Portulaccaceæ, *epigyn.*, Cacteæ (conjunctio cum Euphorbiaceis), Acromyyrsinæ s. Corniculatæ, Mesembryanthemum, *perigyn.*, Crassulaceæ, *hypogyn.*, Cunoniaceæ,* Dilleniaceæ,* *perigyn.*, Escallonieæ, Saxifrageæ, *epigyn.*, Ribesiaceæ* (conjunctio cum Gymnocladio), Rhodomyrsinæ s. Myrtifloræ, Onagrariæ, Melastomeæ, *perigyn.*, Cupheaceæ, Lagerstrœmieæ,* *epigyn.*, Puniceæ, Myrtaceæ, Rhizophoreæ,* Trapa,* Combretaceæ, Philadelpheæ (Deutzia).*

3. Rhinanthæ s. Pnoæ.

Rhodopnoæ, *Rostellatæ,** (Halesia) Styraceæ,* Vaccinieæ, *hypogyn.*, Ericeæ (Fabiana),* Epacrideæ (Epacris impressa,* Kalmia) Rhododendreæ (Arbutus, Royena) Ebenaceæ, Sapotaceæ, Myrsineæ, Primulaceæ (incl. Lentibulariæ), Solaneæ (Datura,* Josephinia) *Personatæ,* Pedalinæ, Bignoniaceæ,* Paulownieæ,* Crescenticæ,* Gesneriaceæ (Trevirana, Ruellia) Acanthaceæ (Russeggera,* Cytinus) Orobancheæ, Rhinanthaceæ (Tozzia,* Mimulus) Gratioleæ (Capraria,* Anticharis) Antirrhineæ* (Collinsia), Cheloneæ (Digitalis), Verbasceæ (Alonsoa), Scrophularieæ, Veroniceæ,* Salpiglosseæ (Duboisia),* Myoporinæ, Stilbinæ, Globularieæ, Selaginæ (Hebenstreitia),* Plantagineæ, (Verbena stricta) Verbenaceæ, Labiatæ (Dracocephalon,* Echium) *Salpinges*, Borragineæ (Heliotropium,* Phacelia) Hydrophylleæ, Hydroleaceæ, Polemoniaceæ (Phlox),* Plumbago, (Euthales) Goodeniaceæ,* Cobæaceæ,* Petunieæ (Nierembergia,* Gilia) Gilieæ, (Ipomopsis) Convolvulaceæ, Cuscuteæ,* Erycibe,* Diapensiaceæ,* *Lampades:* Asclepiadeæ, Apocynaceæ (Nerium * Gentiana) Gentianeæ, (Chlora* Nyctanthes), Jasmineæ, Bolivareæ, Strychneæ, *Olivares:* Loganieæ,* Ligustrinæ,* *epig.*, Nyssa,* Corneæ,* Rubieæ, Cinchoneæ,* Hydrangea,* Sambuceæ,* Valerianeæ (conjunctio cum Spiræa,) Acropnoæ, *hypogyn:* Dipsaceæ, *epigyn:* Calycereæ, Ambrosiaceæ, *Synanthereæ,* Melampodiaceæ (Gymnopsis), *leptopappeæ,* Heliantheæ, Eclipteæ, (Tripteris), Calenduleæ (Cryptostemma,* Lasiospermum) Anthemideæ (Artemisia,* Evax) Evaceæ,* *chætopappeæ,** Gnaphalieæ (Homogyne) Tussilagineæ (Adenostyles,* Cacalia) Senecioneæ (Arnica), Inuleæ (Pulicaria), Baccharideæ, Astereæ, Eupatoriaceæ (Epaltes), Vernoniaceæ, Cynareæ, Mutisiaceæ, Cichoraceæ* (Cichorium), (Elephantopeæ),* Lobeliaceæ, Campanulaceæ* (Stylideæ),* Columelliaceæ,* Nhandirobeæ, Cucurbitaceæ, Papayaceæ, Gronovieæ, Passifloreæ apetalæ epigynæ (conjunctio cum Aristolochia). Charitopnoæ s. Sidæ: Passifloreæ, *perigynæ*, Homalineæ, Samydeæ, Turneraceæ, *hypogyn.*,* Cistinæ, Tiliaceæ, Byttneriaceæ, Sterculiaceæ, Malvaceæ,* Phytolaccaceæ,* Gyrostemoneæ,* Chlænaceæ, Ternstrœmiaceæ, Dipterocarpeæ,* *perigyn.*, Rhizoboleæ.*

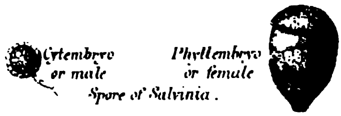
4. Otanthæ s. Ambræ.

Charitambræ s. Acera:* Meliantheæ, Æsculinæ, Sapindaceæ, Staphyleaceæ, Malpighiaceæ, Acerinæ (Negundo, *hypogyn.*),* Fraxineæ,* Celtis, Ulmus,* Ptelea,* Xanthoxyleæ, Aurantiaceæ, Meliaceæ, Cedrelaceæ, Diosmeæ, Rutaceæ, Anacardiaceæ,* *epigyn.*, Juglandeæ,* Corylus,* Myrica,* Cupuliferæ (conjunctio cum Astrantia Xanthioque). Acrambæ: Betulinæ,* Humulinæ,* Thelygonum,* Halorageæ,* Casuarinæ, Ceratophylleæ,* Batis,* Callitrichinæ,* Paronychiaceæ, Polygoneæ (Emex* Spinacia), Chenopodeæ (Camphorosma), Amarantaceæ,* Reaumuriaceæ, Tamariscinæ,* Populinæ, Datisca,* Plataneæ, *epigyn.*, Artocarpeæ, Moreæ, *hypogyn.*, Urticeæ, Ficinæ, Euphorbiaceæ (conjunctio cum Cacto). Myrsinambræ:* Buxeæ,* Empetreæ,* (Nitrariæ, Putranjiveæ,) Aquifoliaceæ,* Hippocrateceæ, Pittosporeæ, *perigyn.*,* Hamamelideæ,* Celastrinæ, Rhamneæ (Phylica), Eleagneæ, Daphnoideæ, Proteaceæ, *epigyn.*, Santalaceæ, *Garryaceæ,* Bruniaceæ,* Alangieæ.*

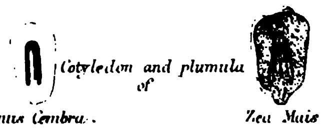


Stubble of a beet from a nat. impression
5/13 Disposition

Cytembryo- or Spore- of Cryptogamae



Cytembryo or male — Phyllembryo or female
Spore of Salvinia.

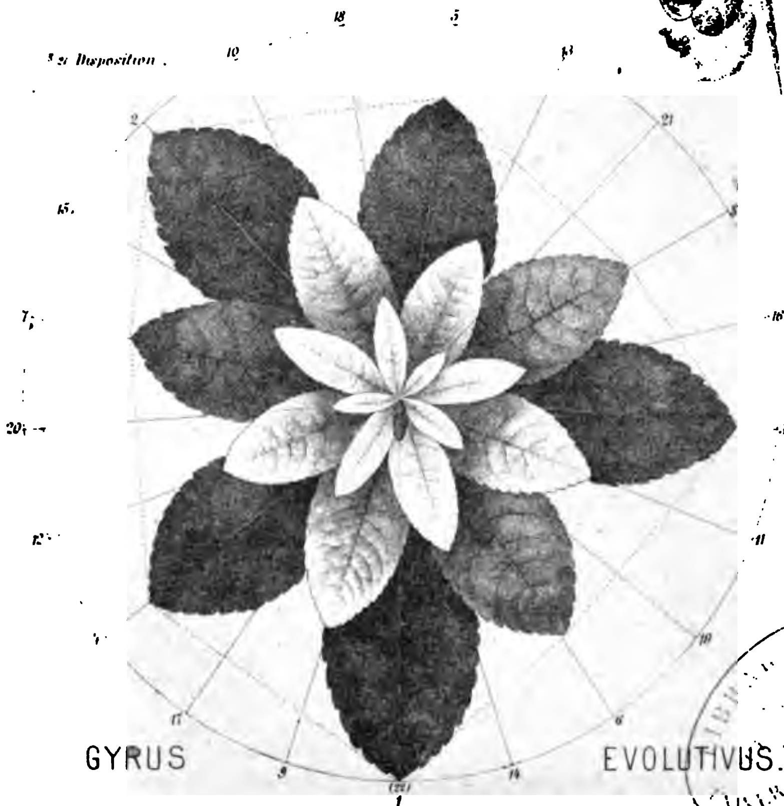


Cotyledon and plumula of
Pinus Cembra. — Zea Mais.

Cytembryo- or pollen-
Grain of Sonchus palustris (Dicotyledoneae)

Germinating bean

8/21 Disposition.



GYRUS EVOLUTIVUS.

5. AMYGDALANTHÆ s. RHODA.

MYRSINORHODA:* Vochysiaceæ,* Polygaleæ,* Simarubeæ, Ochnaceæ,* Connaraceæ, Cæsalpinieæ (conjunctio Gymnocladii cum Ribe). ACRORHODA: Sophorea, Mimosæ (reflectio cum Metrosidero). PNOORHODA: Leguminosæ (conjunctio Trifolii cum Scabiosa) Chrysobalaneæ, Amygdaliferæ (Prunus,* Spiræa) Roseæ, Pomeæ.

Amicissimis viennensibus amicis inscripsit

AUCTOR.

V. *Mastodon Remains, in the State of Missouri, together with Evidences of the Existence of Man contemparaneously with the Mastodon.* By Dr. ALBERT C. KOCH.

It will perhaps be recollected that, some twenty years ago, I commenced making somewhat extensive researches and excavations for Mastodon remains, in the State of Missouri, and continued them until, at one time, I was in possession of more than six hundred teeth of Mastodons of different ages and sexes, seventy-three inferior maxillas, and nearly as large a number of superior maxillas, with portions, greater or less, of the skull attached to them; five skulls; a large collection of tusks of all sizes; numerous bones of the extremities and other parts of the body, and the nearly complete skeleton, described by me under the name of the "*Missourium,*" being the same which is now in the British Museum. This collection contained parts of animals of various ages, from the young suckling to the oldest patriarch, whose last molars were worn down to a level with the gums. By means of this collection, (what had been my principal design in making it), Palæontologists were enabled to throw much light on the dental system of this remarkable genus, then very superficially known. When, however, I brought this collection before the American public, it seemed to be very little appreciated, as was the case, afterwards, with the instructive collection of *Zeuglodon* remains, which I had discovered and exhumed in the State of Alabama; and for this reason I was compelled to take them to Europe, where, their scientific value being more fully acknowledged, they were purchased and placed in the British Museum, and in the Royal Museum of Berlin. The general interest taken in these remains, in Europe, induced me, in addition to a paper which I read before the Geological Society of London, to publish a small work in the German language, at Berlin, in 1845,* in which is given a minute description of all these remains of Mastodon, together with the most important facts connected with their discovery. But inasmuch as this work has never appeared in the Eng-

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* Die Riesenthiere der Urwelt, von Dr. Albert Koch. Berlin, Verlag von Alexander Dunker, 1845.

lish language, and is, perhaps, little known in America, I hope it will not be altogether unwelcome, if I lay before the Academy a repetition of some of the facts which were stated in that work, and which furnish some very striking evidences of the existence of Man, on this continent, in the age of the living Mastodon. I do this the more readily, for the reason that some account of this discovery was published, anonymously, at the time, in the Philadelphia "Presbyterian" newspaper, from which it was copied into the Amer. Jour. of Science (vol. xxxvi. p. 199), with some expressions of regret by the editor, that facts, so highly interesting and important, should be left to rest on anonymous authority merely.

I will state then, that, in the year 1839, I discovered and disinterred, in Gasconade county, Missouri, (Lat. 38° 20′ N.) at a spot, in the bottom of the Bourbeuse River, where there was a spring, distant about four hundred yards from the bank of the river, the remains of one of the above-named animals. The bones were sufficiently well preserved to enable me to decide, positively, that they belonged to *Mastodon giganteus*. Some remarkable circumstances were connected with this discovery. The greater portion of these bones had been more or less burned by fire. The fire had extended but a few feet beyond the space occupied by the animal before its destruction; and there was more than sufficient evidence on the spot, that the fire had not been an accidental one, but, on the contrary, that it had been kindled by human agency, and, according to all appearance, with the design of killing the huge creature, which had been found mired in the mud and in an entirely helpless condition. This was sufficiently proven by the situation in which I found as well those parts of the bones which had been untouched by the fire, as those which were more or less injured by it, or in part consumed; for I found the fore and hind legs of the animal in a perpendicular position, in the clay, with the toes attached to the feet, in just the same manner in which they were, at the moment when life departed from the body. I took particular care, in uncovering these bones, to ascertain their position, beyond any doubt, before I removed any part of them; and it appeared, during the whole excavation, fully evident, that, at the time when the animal in question found its untimely end, the ground, in which it had been mired, must have been in a plastic condition, being now a greyish colored clay. All the bones which had not been burnt by the fire had kept their original position, standing upright and apparently quite undisturbed in the clay; whereas those portions, which had been exposed above the surface, had been partially consumed by the fire; and the surface of the clay was covered, as far as the fire had extended, by a layer of wood ashes, mingled with larger, or smaller, pieces of charred wood and burnt bones, together with bones, belonging to the spine, ribs, and other parts of the body, which had been more or less injured by the fire. The fire appeared to have been most destructive around the head of the animal. Some small remains of the head were left unconsumed, but enough to show that they belonged to the Mastodon. There were, also, found mingled with these ashes and bones, and partly protruding out of them, a large number of broken pieces of rock, which had evidently been carried thither from the shore of the Bourbeuse river, to be hurled at the animal by his destroyers; for the above-mentioned layer of clay was entirely void of even the smallest pebbles: whereas, on going to the river, I found the stratum of clay cropping out at the bank, and resting on a layer of shelving rocks of the same kind as the fragments; from which place, it was evident they had been carried to the scene of action. The layer of ashes, etc., varied, in thickness, from two to six inches; from which it may be inferred that the fire had been kept up for some length of time. It seemed that the burning of the victim, and the hurling of rocks at it, had not satisfied its destroyers; for I found, also, among the ashes, bones, and rocks, several arrow-heads, a stone spear-head, and some stone axes, which were taken out in the presence of a number of witnesses, consisting of the people of the neighborhood, attracted by the novelty of the excavation. This layer of ashes, etc., was covered by strata of alluvial deposits, consisting of clay, sand, and soil, from eight to nine feet thick, forming the bottom of the Bourbeuse, in general; and on the surface, near the centre of the spot on which the animal had perished, was situated the spring, the water of which was used for domestic purposes; and it was in digging to clear out the spring, that the existence of bones there had been first discovered by the owner of the land.

It was about one year after this excavation, that I found, at another place, in Benton county, Missouri, in the "bottom" of the *Pomme de Terre* river, about ten miles above its junction with the Osage, several stone arrow-heads mingled with the bones of the same nearly entire skeleton mentioned above as the "*Missourium.*" This discovery is already so well known, that I will merely mention the circumstance, in this connection, that the two arrow-heads found with the bones were in such a position as to furnish evidence still more conclusive, perhaps, than in the other case, of their being of equal, if not older date, than the bones themselves; for, besides that they were found in a layer of vegetable mould which was covered by twenty feet in thickness of alternate layers of sand, clay, and gravel, one of the arrow-heads lay underneath the thigh-bone of the skeleton, the bone actually resting in contact upon it; so that it could not have been brought thither after the deposit of the bone; a fact which I was careful thoroughly to investigate.

This layer of vegetable mould was some five or six feet thick, and the arrow-heads and bones were found, not upon its surface, but deeply buried in it, together with fragments of wood and roots, and logs and cones of cypress; but no pebbles were observed in it.

Above this layer of mould there were six distinct undisturbed layers of clay, sand, and gravel, viz., three of greyish clay, and three of pebbly gravel mixed with coarse sand; in all, twenty feet in thickness; and a forest of old trees was standing on the surface soil. This bottom is still subject to occasional overflow, in very high stages of water.

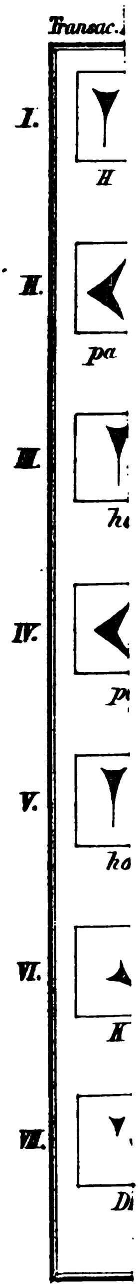
If we consider the manner in which these river bottoms have been formed, as it has been admirably illustrated by Prof. Swallow, (Rep. of Geol. Sur. Missouri,) the layers of vegetable mould appearing to have been formed at the bottom of lakes, or in swampy depressions, left filled with water on the retiring of the greater overflows, or on a change of the bed of the river, at distant periods of time, and that, in these lakes and depressions, a deposit, at first, of clayey sediment, and then, of decaying vegetable matters, gradually accumulates to a considerable depth, before another overflow covers the whole, again, with a layer of sand and gravel, it would seem necessarily to be inferred, that this animal must have perished in such a lake, or swamp, and that his skeleton, being thus quietly deposited, was slowly covered over in course of the gradual formation of the vegetable layer; and that it could not have been drifted by the high waters of the river from another and older position to be re-deposited upon the arrowhead at a period later than that in which the Mastodon lived.

VI. *Notice of a Burnt Brick from the Ruins of Nineveh.* By Prof. G. SEYFFARTH. (*Plate IV.*)

I take the liberty of calling attention to a burnt brick from Nineveh, the property of a gentleman of St. Louis, perhaps the greatest literary curiosity of this city, and probably the only specimen in the United States. The brick is nearly 20 inches by 20, and 4 inches thick; and it contains a cuneiform inscription of seven lines. What may be the contents of this inscription, and to what epoch does it belong? Let us see.

There are four kinds of cuneiform inscriptions: the so called Persian, the Median, the Assyrian, and the Babylonian. The language in which these inscriptions speak to us is the Old Persian, the mother of the modern Persian, preserved in the Zend and Pehlvi, related to the Sanscrit, the Greek, Latin, German, and, in short, to all the Japhetic languages.

This cuneiform character was taken, a long time since, for the primitive writing, prior to the Phœnician, Hebrew, Greek, and other alphabets. In 1820, however, I demonstrated, that those cuneiform letters of the Persians, Medes, Assyrians, and probably that of the Babylonians also, had the Hebrew, or rather Noa-


Transac.
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chian, alphabet for their basis.* For, all those groups of wedges originate from combinations of different wedges; and by bringing them, particularly the 36 Persian groups, into a row or file, according to the law of combination, it appears that these letters then follow, the one after the other, like the letters of our alphabet: *a*, *b*, *c*, and so on. Thus, the 36 cuneiform groups of the Persians correspond with the 36 letters of the modern Persians. Those 200 groups of the Median system express the same 36 letters, pronounced with different vowels, as Westergoord confirmed, four years after the publication of my "Alphabeta Genuina."† The Assyrian groups, of which 400 are already known, signify, partly, those 36 single letters; partly, the same combined with vowels, and, partly, the same joined to different consonants; as it was first shown in my "Alphabeta Genuina," and confirmed, some years ago, by Rawlinson. My Cuneiform Alphabet of the Assyrians, published sixteen years ago, is not at all complete; and my Cuneiform Dictionary, as everybody will find in my book (p. 124—138), is a very poor one. Notwithstanding, it has been considered as the first key to this immense new literature. Rawlinson, in the midst of Assyrian antiquities, has adopted, enlarged, and, without doubt, corrected it; his book, however, with his Alphabet, Dictionary, and numerous translations of entire inscriptions, I have not yet been able to examine. Nevertheless, I am happy to be able to give some information concerning the Assyrian inscription upon this brick, which, after many hundred years, has made its way from old Nineveh to St. Louis, through the instrumentality of Mr. Marsh, an American Missionary, at Mosul. The cuneiform groups of the brick read as follows:

I: *Hauro—Muzdasa*
II: *pabou paopala*
III: *hosdho* (?) *pamalho*
IV: *pabou paopala*
V: *horuz paopala dah*
VI: *Koshaulsa hbuna kha*
VII: *Dhalhabosh.*

That is: "*Xerxes, the son of Darius* (namely, Hystaspes, 518 B. C.), *the Lord of the earth, the master of the earth, has given* (the building in question) *to Hormuzd* (the Persian name of God), *to the Lord of the earth, to the king* (?) *of the people.*"

This brick, then, is now 2300 years old; it was burnt in the

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* Alphabeta genuina Ægyptiorum, nec non Asianorum, literis Persarum, Medorum, Assyriorumque cuneiformibus, Zendicis, Pehlvicis et Sanscriticis subjecta. Accedit dissertatio de mensuris in S. S. memoratis, per antiquas ulnas Ægyptiacas Taurinensem, Parisinam, Lugdunensem illustratis: cum VI Tabulis alphabeticis. Lipsiæ, 1840.

† On the deciphering of the second Achæmenian, or Median species of Arrow-headed Writing. See *Memoires de la Societe des Antiquaires du Nord. Copenhag.* 1844.

time of Xerxes (d. 463 B. C.); and thus it is demonstrated, that the ruins of Nineveh, where the brick was dug up, or at least some parts of those ruins, are indeed 160 years posterior to the year 626 B. C., to which Layard has referred them. This fact was first proved by an Egyptian inscription, containing the name of Pharaoh Hophra (586 B. C.), now in the British Museum, which was found among Assyrian antiquities taken from the ruins of the palaces of Nineveh. After the destruction of Jerusalem (586 B. C.), Nebuchadnezzar overcame Hophra; and so, he brought those Egyptian antiquities to his palaces at Nineveh. This subject has been explained more extensively in the German translation of Layard's Nineveh, Leip. 1855.‡

My deciphering of this cuneiform inscription, I confess, contains some doubtful letters; but the proper names, and many other words, are certain, as similar inscriptions prove. Nobody can give more than he has to give. The Assyrian names of Ormuzd, Xerxes, Darius, differ somewhat from their Greek pronunciation; but they are, in other inscriptions of the Parsees, Medes, and Assyrians, written and pronounced in like manner. From the Bible, it is already known, that the Orientals pronounced *Dâriavesh* instead of *Darius*. The second letter of the third line is probably incomplete, and, therefore, the word is doubtful.

VII. *Indian Stone Graves in Illinois.*

By A. Wislizenus, M.D.

In the neighborhood of Prairie du Rocher, Randolph county, Ills., three miles east of the Mississippi and of the old Fort Chartres, there are found many old burying-grounds, belonging undoubtedly to past Indian generations. Many of the graves have already, out of mere curiosity, been opened, and their valuable contents been carried off, or destroyed, without throwing any light upon their mysterious origin. When I happened, therefore, in May, 1843, to spend some time in that vicinity, I took occasion to open as many of these graves as my time allowed, to take notes on the spot, and to collect the most valuable objects as far as their state of preservation permitted. The result of my researches I lay, at present, before you. Though I opened a great number of graves, I will mention only those which presented some peculiarity either in their construction or contents.

The first place, where I commenced my researches, was about half a mile north of Prairie du Rocher, on a small knoll in the

‡ The Egyptian Antiquities in the Ruins of Nimroud, and the year of Nineveh's Destruction.

woods. The ground was covered with many flat graves, recognizable generally by the prominency of one or more vertical stones forming the walls of the grave. All the graves were close together. The first one I opened,

Grave No. 1, had its direction from east to west, and measured about 5 feet in length, from 1 to 1½ feet in width, and about 15 inches in depth. This space was enclosed with flat limestones, such as the neigboring bluffs and country around afford. The stones were of various sizes, and were joined together without mortar. The bottom of the grave was formed by a horizontal layer of these stones; a like one is generally on the top of the grave; but the top one was here wanting,—a proof that the grave had been disturbed. In removing the loose earth, which filled the entire grave, we found, at a depth of half a foot, some fragments of human bones; amongst others, a piece of a lower jaw belonging to a child about six years of age. The skull bones with some fragments of pottery were lying northwards, the rest of the bones towards the west.

The second grave which I opened there, a few steps only from the first,

Grave No. 2, was constructed in the same way, but measured only 28 inches in length, 12 to 14 inches in width, and about 1 foot in depth. This grave, also, seemed to have been disturbed. I found in it only fragmentary bones of the extremities and a piece of the skull, all belonging to a very young child.

The next burying-ground I explored was a cave in the bluffs, about two miles north of Prairie du Rocher. No regular graves existed here, but in the loose ground many human bones of large size were promiscuously thrown together: some pieces of flint were found with them. As I could not discover any skulls, and as the place was very narrow and dark, I left it for another burying-ground on the bluffs, where, on a small natural eminence, regular stone-built graves were again found. I opened the following graves:

Grave No. 3.—Direction from S.E. to N.W.; length, 7 feet; width towards the N.W., where the skull was, 18 inches—towards the S.E., where the feet lay, 19 inches. In digging half a foot through the sandy ground, we came to the horizontal top-layer of flat stones, and, below this, to a very complete and well preserved skeleton of an old man. After having cautiously removed the sandy earth, which filled the interior of the grave, we saw the entire skeleton fully extended before us, lying on its back, the arms stretched along the body, the face turned towards the west. All the bones were so well preserved, that I took the whole skeleton with me. When carefully dug up, the fragile bones soon dried in the air, and allowed transportation. On the left side of the skull, which was remarkable for its great frontal-occipital length, we found a large marine shell (*Pyrula*); on the right, two pointed instruments prepared from birds' wings, and used probably as awls.

Graves Nos. 4, 5, *and* 6, which I opened in the same locality, were quite similarly constructed, though not quite so long, and the bones in them were not quite so well preserved. I took two fragmentary skulls from them, but neither ornaments, instruments, nor weapons.

The fourth burying-place I explored was about three miles north of Prairie du Rocher, on a slight elevation, belonging to the farm of Mr. Fisher. As the land is in cultivation, most of the graves have been destroyed. Their construction was the usual one. In one of them, which I opened here,

Grave No. 7, the direction was from N.W. to S.E., the head lying N.W., the feet S.E. The length of this grave was 6 feet 8 inches; the width at the foot, 14 inches; at the head, 11 inches; the depth, 19 inches. After having removed the horizontal top-layer, we found the skeleton stretched out as usual, and lying on its back. Between the feet we found an instrument, formed of animal bone, which might have been used for digging or scraping. The human bones were too brittle to be removed, with the exception of the lower jaw, that contained nearly all the teeth, and belonged to a full grown person.

From hence I went east to a neighboring hill, where I opened the following graves:

Grave No. 8.—Direction from E. to W., the head towards the W., construction as usual. I found the skull in it very well preserved, of squared form, and belonging to an aged person. On the right of the skull an earthen vessel was found; on the left, two river shells (*Unio ellipsis* and *angulatus*), which are found in the Kaskaskia, the Ohio, and other tributaries of the Mississippi, and a very small marine shell (*Marginella*). A similar earthen vessel, with the figure of an animal head upon it, I bought of a neighboring farmer, who had dug it out of one of these graves. These vessels are made of clay mixed with broken shells, and are skilfully worked. Besides the vessel and the shells, we found in this grave some sharp pieces of flint, and an instrument like a knitting-needle, made of animal bone.

Graves Nos. 9 and 10 exhibited quite a different construction from any of the others. The stones of these graves formed a circle 3 feet in diameter, with horizontal top and bottom layer, as usual. Skulls, and other bones of several persons, were quite promiscuously thrown together, but all so decayed that I could save nothing. No instruments, nor weapons, were found here. A man, who dug for me, and who had opened many hundred graves, told me that he met here for the first time with this construction.

Grave No. 11 had, again, the common lengthy form. The direction was from N. to S., the skull towards the S., and tolerably well preserved. Around the neck we found 24 beads, which had formed a necklace. They were made from the joints of Unio shells, were perforated in the middle, and strung together by sinews, fragments of which I found still in them.

After having gone through these specialities, allow me now to give a short *resumé* of my observations, to draw some general conclusions from them, and to venture an opinion respecting the origin of these graves.

1. The general construction of these graves is coffin-like, their side walls, top, and bottom, being formed by flat limestones, joined together without cement. The size of the graves was adapted to that of the persons to be buried in them. We find them, therefore, in length, from 1½ to 7 feet; in width, from 1 to 1½ feet; and, in depth, from 1 to 1½ feet. The top-layer of stones is seldom deeper than half a foot below the ground.

2. The graves are always close together, but there is no apparent order in their position and direction. I counted from 20 to 100 graves in different burying-grounds.

3. Children seem to have been buried in separate ground.

4. All the burying-places are situated on some elevation, slight as it may be. The bluffs, forming there a continuous chain of little cones, were, therefore, preferred for that purpose.

5. In the graves, that have been the least disturbed, the skeleton is found stretched out at its natural length, and lying on the back. Being aware of the customary sitting posture in Indian graves, I was anxious to ascertain this point; but, having found the bodies constantly in the same position, I entertain no doubt of the correctness of my present statement. The ornaments and instruments are generally found on both sides of the head; sometimes in the hands, or between the feet.

6. The only weapons found in these graves are pointed flints, tomahawks of stone, instruments made of animal bones, etc.; but never yet have metallic weapons, or instruments, been discovered in them.

7. The pottery, found in them, shows more expertness in that art than the present Indians possess.

8. The marine shells, found in some of the graves, prove direct, or indirect, connection with the sea-coast.

9. Of skulls, which I considered the most valuable part of my discoveries, I got but four well preserved ones, which I presented to the late Dr. Morton, of Philadelphia, for his craniological cabinet. All of them bear the unmistakable signs of the American race, to-wit: the broad massive lower jaw, high cheek-bones, salient nose, full superciliary ridge, low forehead, prominent vertex, and flattened occiput.

10. The American race has been divided into two great families, the *Toltecan* family, and the *American* family proper. The skulls of the Toltecan family are characterized by greater roundness and smallness, by a decided truncation of the occiput, and by an apparent irregularity in both sides of the skull. This irregu-

circular, or very slightly elliptical, facet, striated in radii for articulating with the column. This perforation is very minute; its form unknown.

The *radial pieces* are thick, and about one-fourth wider than long. Their lateral margins diverge slightly from below upwards; the superior edges are deeply excavated about two-thirds the width of the pieces, to accommodate the two first brachials, and on either side of the excavations is a short, oblique, straight edge, on which rests an inferior oblique edge of an interradial. The basal edges of four of the pieces are straight; the fifth is very obtusely angulated below. The radial pieces are all very tumid just below the excavations for the brachials.

The *interradial pieces*, four in number, alternate with the radials. They are small, a little elongated, hexagonal (?) and very slightly concave.

The *brachial pieces* are so badly weathered that their characters are not to be made out. We only see plainly that there are two resting in the excavated upper edge of each radial piece.

The *anal plate*, which rests on the base, is tumid above, elongated, hexagonal, widest in the middle, and extends above the radial pieces. The other anal pieces are unknown.

Column and *vault* unknown.

Dimensions.—Height of calyx, $4\frac{1}{2}$ lines; greatest width of same, 6 lines; height of base, $1\frac{1}{4}$ lines; its great diameter, $4\frac{1}{2}$ lines; smallest diameter, $3\frac{2}{3}$ lines; height of radial pieces, 3 lines; width, $3\frac{1}{4}$ to $3\frac{1}{2}$ lines; height of anal piece, $3\frac{1}{2}$ lines; greatest width, about 3 lines.

This Dichocrinus is closely related to *D. cornigerus*, from which it may be distinguished by the greater proportional width of its calyx, its prominent six-lobed outline when seen from below, and the greater tumidity and width of its radial pieces. The base is, also, less elongated in a transverse direction.

Formation and locality.—We possess but a single specimen of the species, the petrifying material of which is silex. It was obtained from the Archimedes Limestone, at Russellville, Kentucky, where it was found associated with *Pentremites florealis* and other fossils characteristic of that formation.

Dichocrinus simplex. (*Shum.*)

Pl. I. Fig. 2, a, b.

The *calyx* of this little Dichocrinus is bead-shaped, or cylindrico-elliptical, its length and breadth about equal, and the plates rather thin and smooth (?)

The *base* is semi-globose, and forms about two-thirds the entire height of the calyx. The pieces of which it is composed are much thicker below than above. The facet for articulating with the last joint of the column is small, circular, and lies in a deep cavity which is a little wider than the facet.

The *radial pieces* are higher than wide, evenly convex, and

VIII. *Description of new* Fossil Crinoidea *from the Palæozoic Rocks of the Western and Southern portions of the United States.* By B. F. Shumard, M.D.

Genus Dichocrinus.

The formula of the genus Dichocrinus of Munster, as given by De Koninck and Le Hon,* is as follows:

Basal	pieces,	2.
Radial	"	4, of which one is large $\times 5$.
Interradial	"	unknown.
Anal	"	1 known, very large, reposing on the base.
Arms,		10.

The anatomical structure of a very perfect specimen of this genus, which we are about to describe, corresponds only in part with the above formula. In our fossil we find a base of two pieces, supporting a circle of five large radials, and one large anal piece, as in all the known species of the genus. The radials, however, are not repeated, but each one immediately gives rise to two brachial pieces, which are pentagonal, and in turn support, each, two simple arms; so that the number of the latter amounts to twenty. The Messrs. Austin, who, up to this time, have figured the most perfect example of the genus, represent the number of radial pieces to be twenty, i. e., five repeated four times.†

In *Dichocrinus ovatus*, described by Dr. Owen and the author of this paper, there appear to be but ten, i. e., five repeated twice;‡ while in *D. cornigerus* and *D. sex-lobatus*, now described for the first time, the whole number of radials is only five. It appears, therefore, that the number of these pieces is not uniform in the different species.

The number of arms is, also, variable. Thus, in *D. fusiformis* (*Austin*) they amount to ten; in *D. cornigerus* (*new sp.*) there are, as already stated, twenty; and I have in my possession a leaden cast of an undescribed species, the original of which is in the cabinet of Mr. S. S. Lyon, of Jeffersonville, Ind., that also exhibits very plainly the same number.

All the American species of Dichocrinus appertain, exclusively, to the Mountain Limestone or inferior division of the Carboniferous System. I am, at present, acquainted with eight well marked species of this genus, from strata of the Western and Southern States. Of these, two are from the Encrinital Limestone; all the others are from the Archimedes Limestone, as lim-

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* *Recherches sur les Crinoïdes du Terrain Carbonifere de la Belgique.*

† Monograph on Fossil Crinoidea.

‡ Descriptions of fifteen new species of Crinoidea, etc. Jour. Acad. Nat. Sci., Philad. New Series. Vol. I.

circular, or very slightly elliptical, facet, striated in radii for articulating with the column. This perforation is very minute; its form unknown.

The *radial pieces* are thick, and about one-fourth wider than long. Their lateral margins diverge slightly from below upwards; the superior edges are deeply excavated about two-thirds the width of the pieces, to accommodate the two first brachials, and on either side of the excavations is a short, oblique, straight edge, on which rests an inferior oblique edge of an interradial. The basal edges of four of the pieces are straight; the fifth is very obtusely angulated below. The radial pieces are all very tumid just below the excavations for the brachials.

The *interradial pieces*, four in number, alternate with the radials. They are small, a little elongated, hexagonal (?) and very slightly concave.

The *brachial pieces* are so badly weathered that their characters are not to be made out. We only see plainly that there are two resting in the excavated upper edge of each radial piece.

The *anal plate*, which rests on the base, is tumid above, elongated, hexagonal, widest in the middle, and extends above the radial pieces. The other anal pieces are unknown.

Column and *vault* unknown.

Dimensions.—Height of calyx, 4½ lines; greatest width of same, 6 lines; height of base, 1¼ lines; its great diameter, 4½ lines; smallest diameter, 3⅔ lines; height of radial pieces, 3 lines; width, 3¼ to 3½ lines; height of anal piece, 3½ lines; greatest width, about 3 lines.

This Dichocrinus is closely related to *D. cornigerus*, from which it may be distinguished by the greater proportional width of its calyx, its prominent six-lobed outline when seen from below, and the greater tumidity and width of its radial pieces. The base is, also, less elongated in a transverse direction.

Formation and locality.—We possess but a single specimen of the species, the petrifying material of which is silex. It was obtained from the Archimedes Limestone, at Russellville, Kentucky, where it was found associated with *Pentremites florealis* and other fossils characteristic of that formation.

DICHOCRINUS SIMPLEX. (*Shum.*)

Pl. I. Fig. 2, a, b.

The *calyx* of this little Dichocrinus is bead-shaped, or cylindrico-elliptical, its length and breadth about equal, and the plates rather thin and smooth (?)

The *base* is semi-globose, and forms about two-thirds the entire height of the calyx. The pieces of which it is composed are much thicker below than above. The facet for articulating with the last joint of the column is small, circular, and lies in a deep cavity which is a little wider than the facet.

The *radial pieces* are higher than wide, evenly convex, and

The *anal pieces* consist of one large octagonal, and a great many small polygonal plates. The first, which is the largest piece in the body, is higher than wide, rests directly on the base, and extends above the summits of the radial plates. The lateral borders are nearly parallel, and the superior edges bear five small plates, which support several ranges of nine or ten plates, very variable in form and size. All of these pieces are smooth, and plane, or very slightly convex.

The *vault* is composed of a great many polygonal pieces, which are very variable in size: some of them are flat, or slightly convex, some are very convex, and others are prolonged into prominent spines. The principal piece is wedge-shaped, and stands on one side directly above the anal opening from which it is separated by three or four rows of very minute pieces. The vault, as a whole, is somewhat hemispherical, higher than the calyx, and much flattened on the anal side. It is divided into six longitudinal lobes, five of which stand directly over the radial pieces, and the sixth over the large anal piece. The former are quite prominent, and are separated from each other by deep, longitudinal furrows; but the anal lobe is slightly prominent, and the furrows on either side very shallow.

The *proboscis* is lateral, and situated on the anal side; but, unfortunately, the specimen is fractured at this part, so that its position is merely indicated by an aperture, surrounded by many little polygonal plates.

Arms.—The number of arms, as above stated, is twenty, but only one or two of the first joints are preserved in the specimen. They are divided into fours by intervals about once and a half times the width of the first arm joints, excepting that on the anal side, which has a width equal to about six of these joints.

Column.—A single plate of the column still adheres to the base in the specimen figured, and this not perfect. It is very small, apparently circular, and its articular face striated on the margin.

Dimensions.—Height of body, 7 lines; greatest width, at junction of calyx and vault, 5½ lines; height of calyx, 3 lines; height of base, about 1 line; great diameter of same, nearly 4 lines; short diameter of same, 3 lines; height of radial pieces, 2¼ lines; height of large anal piece, 3 lines.

DICHOCRINUS SEX-LOBATUS. (*Shum.*)

Pl. I. Fig. 3, a, b, c.

The *calyx* of this species is of a more depressed conical form, and the plates thicker, and more tumid, than in the preceding species; viewed from beneath, the outline is very distinctly six-lobed.

The *base* is octagonal, short, convex, a little extended transversely, and composed of two smooth, pentagonal pieces. Below, we find a shallow indentation of an elliptical form occupying about one-third of its length, at the bottom of which is a minute

circular, or very slightly elliptical, facet, striated in radii for articulating with the column. This perforation is very minute; its form unknown.

The *radial pieces* are thick, and about one-fourth wider than long. Their lateral margins diverge slightly from below upwards; the superior edges are deeply excavated about two-thirds the width of the pieces, to accommodate the two first brachials, and on either side of the excavations is a short, oblique, straight edge, on which rests an inferior oblique edge of an interradial. The basal edges of four of the pieces are straight; the fifth is very obtusely angulated below. The radial pieces are all very tumid just below the excavations for the brachials.

The *interradial pieces*, four in number, alternate with the radials. They are small, a little elongated, hexagonal (?) and very slightly concave.

The *brachial pieces* are so badly weathered that their characters are not to be made out. We only see plainly that there are two resting in the excavated upper edge of each radial piece.

The *anal plate*, which rests on the base, is tumid above, elongated, hexagonal, widest in the middle, and extends above the radial pieces. The other anal pieces are unknown.

Column and *vault* unknown.

Dimensions.—Height of calyx, $4\frac{1}{2}$ lines; greatest width of same, 6 lines; height of base, $1\frac{1}{4}$ lines; its great diameter, $4\frac{1}{2}$ lines; smallest diameter, $3\frac{2}{3}$ lines; height of radial pieces, 3 lines; width, $3\frac{1}{4}$ to $3\frac{1}{2}$ lines; height of anal piece, $3\frac{1}{2}$ lines; greatest width, about 3 lines.

This Dichocrinus is closely related to *D. cornigerus*, from which it may be distinguished by the greater proportional width of its calyx, its prominent six-lobed outline when seen from below, and the greater tumidity and width of its radial pieces. The base is, also, less elongated in a transverse direction.

Formation and locality.—We possess but a single specimen of the species, the petrifying material of which is silex. It was obtained from the Archimedes Limestone, at Russellville, Kentucky, where it was found associated with *Pentremites florealis* and other fossils characteristic of that formation.

Dichocrinus simplex. (*Shum.*)

Pl. I. Fig. 2, a, b.

The *calyx* of this little Dichocrinus is bead-shaped, or cylindrico-elliptical, its length and breadth about equal, and the plates rather thin and smooth (?)

The *base* is semi-globose, and forms about two-thirds the entire height of the calyx. The pieces of which it is composed are much thicker below than above. The facet for articulating with the last joint of the column is small, circular, and lies in a deep cavity which is a little wider than the facet.

The *radial pieces* are higher than wide, evenly convex, and

widest inferiorly. Four of them are quadrangular, their inferior edges rounded, and one is pentagonal and wider than the other pieces. In fact, all the radial pieces differ from each other, more or less, in width.

The *anal piece* resting on the base is all that is known. It presents nearly the same form and dimensions as the pentagonal radial piece.

The *column, arms*, and *vault*, are unknown.

Dimensions.—Height of calyx, 4½ lines; height of base, 2 lines; diameter of same, 4 lines; width of anal piece at base, 2½ lines; do. at top, 1½ lines.

For the fine specimen of this species, from which the above description has been drawn, I am indebted to my friend, Prof. L. P. Yandell, of Louisville, Kentucky, whose extensive collection of rare American Crinoids contains some fine examples of it. They occur in the Archimedes Limestone exhibited in the railroad cut at Spergen Hill, Clarke County, Indiana, where they are associated with *Pentremites florealis, P. laterniformis*, and *Actinocrinus* (*Batocrinus*) *icosidactylus.*

The calyx entire is very rarely found, as the plates separate very readily at the sutures, but single plates are quite common. I have, also, found the basal plates of this species at St. Mary's Landing, Ste. Genevieve County, Missouri.

ACTINOCRINUS MULTIRADIATUS. (*Shum.*)

Pl. I. Fig. 5.

The *body* of this fine species is of medium size, and its general form subovate.

The *calyx* is subconical, with its sides somewhat inflated. The plates are moderately thin, and their surface elegantly ornamented with distinct radiating ribs, which commence at, or near, the middle of each piece, and, crossing the sutures, unite with others from the adjacent pieces, in such a manner as to form a number of nearly equilateral triangles around the body, the principal ones enclosing one, and sometimes two smaller triangles. The points of the large triangles are not unfrequently marked with a small tubercle.

The *base* is composed of three nearly equal pieces, which form a low cup with rapidly expanding sides. Beneath is an obscurely hexagonal, slightly concave space, in which is a circular facet, occupying about two-fifths the width of the base, for receiving the last joint of the column. The central opening is moderately large, and appears to be pentalobate.

The 1*st radial pieces* are large, and most prominent in their centres. Three of them are hexagonal, and two heptagonal; those which unite with the first anal piece have a length and breadth about equal, but the others are widest transversely. The greatest width of the pieces is at two-thirds the height. The inferior lateral edges are longer than the superior ones; the basal edges of the hexagonal pieces are slightly rounded; the heptagonal pieces obtusely angulated. The *2d radials* are hexagonal, and about one-third the size of the 1st radials. The *3d radials* are small, short, heptagonal, and, being axillary pieces, support two *brachials* which are short and hexagonal.

The *interradial pieces* amount to three between each of the radial rows. The first is hexagonal, and its size about the same as the 2d radial pieces. It supports two smaller pieces, also apparently hexagonal.

Anal pieces.—The first is large, hexagonal, a little elongated, and reposes upon the base. This supports on its upper edges two small hexagonal pieces, one of which is larger than the other. The form of the succeeding anal pieces can not be determined.

The *vault*, compared with the calyx, is very low. It is convex, and composed of a number of polygonal plates, often marked with small tubercles, or short ridges.

The *proboscis* is elongated, situated nearest the anal side, and tapers gradually as it leaves the vault. A fragment, about a third of an inch in length, is all that is preserved in the specimen.

Arms.—Only the commencement of the arms is exhibited. They are directed a little upwards, and come off in pairs; the pairs being separated from each other by wide intervals, that on the anal side being more than double the width of the others.

Dimensions.—Height of body to base of proboscis, 11 lines; transverse diameter at base of free arms, about 10 lines; length of calyx below arms, 6½ lines; height of base, 1½ lines; diameter of same, 5 lines.

This species is nearly related to *Actinocrinus concinnus* (*nobis*), but may be distinguished by its smaller size, the greater height of the base, and its more elongated calyx.

Locality and formation.—I found this handsome species of Actinocrinus near the base of the Archimedes Limestone (Mountain Limestone), in the quarries of the Mississippi bluffs, at Quincy, Illinois. It occurs there with *Spirifer striatus* (large var.) and Actinocrinus (Dorycrinus) Mississippiensis (Rœm.) Perfect specimens of the body are rarely found, but I have observed detached plates of it at several localities in Missouri and Iowa.

Actinocrinus Yandelli. (*Shum.*)

Syn., Actinocrinites, *Yandell & Shumard*—Contributions to the Geology of Kentucky, p. 24. *Fig.* 5, *a*, *b*.

The *summit* of this magnificent species of Actinocrinus is somewhat globose, the plates thick and very prominent in their centres, and sometimes granulated.

The *calyx* is short, inverted conical, and occupies about onethird the height of the body.

The *base* is very low, wider beneath than above, and its internal cavity quite shallow. The inferior border is emarginate at the sutures, which divide it into three well-defined, broad lobes, which are marked on the middle of the under surface by a shallow groove, forming an interrupted circle around the base. The articular surface for the column is round, crenulated at the margin, and occupies about one-half the width of the base. The superior edge is nine-angled, six of the angles being salient, the others retreating.

The *1st radial pieces* are transverse, their width double the height; three are hexagonal and two heptagonal, the inferior edges of the former slightly arched, the latter obtusely angulated. The superior edges of all of them are slightly concave, and the upper oblique edges rather short. The surface of each plate is furnished with a prominent transverse curved ridge, the convexity of the curve being usually downwards. These ridges are, in some specimens, studded with several granules. The *2d radials* are only about one-fourth the size of the last, transverse, quadrangular, and their superior and inferior edges a little arched. The *3d radials* are transverse, irregularly pentagonal, sometimes hexagonal, and support on their oblique upper edges two short brachial pieces. These are pentagonal and hexagonal, vary much in their proportions, and the superior ones, being axillary pieces, support a double series of brachials of the 2d order, which are very short and irregular. The number of brachial pieces, however, is subject to irregularity, as in the specimen represented by the figures 4 *b* and *c*. In this, we find one of the 3d radials supporting only a single brachial piece of the 1st order, instead of a double pair, as in the others, which piece is axillary, and bears on its upper edge a double row of brachials of the 2d order. A similar irregularity occurs, also, in one of the brachial groups of the 2d order, in the same specimen.

Interradial pieces.—Between every two radial rows, we have three, and sometimes four, interradials, of which the principal ones have a length and breadth about equal, and are usually ten-sided, but sometimes eleven-sided. On these rest two smaller pieces, very irregular in form and size, one of them usually much more elongated than the other.

The *anal pieces* amount to ten or eleven in number. The first is hexagonal, rests on the base, and is a little higher and narrower than the others. On its superior edge rests a slightly elongated hexagonal piece, on either side of which is a polygonal piece, the three being of nearly the same size and smaller than the one resting on the base. To these succeed three still smaller pieces, unequal and irregular, which in turn support the same number of elongated pieces.

The *vault* is conical, forms about two-thirds the height of the base, and consists of a great many pieces, mostly hexagonal and heptagonal. They are rather large, increase in size from below upwards, and nearly all of them are raised in their centres, and, in some specimens, garnished with small tubercles.

The *proboscis* is sub-central, elongate-conical, and from an inch to an inch and a half long. I have in my collection a proboscis, apparently belonging to this species, which bifurcates near its middle, and presents somewhat the form of the letter Y, the prongs being about half an inch long.

The *arms* come off, at nearly right angles to the axis of the body, in groups of four, and sometimes five, separated by distinct intervals. The commencement of 21 arms is to be seen on one of the specimens figured, and 22 on the other.

The *column* is unknown.

Dimensions.—Height of body, including proboscis, 2⅝ inches; do. of calyx, ¾ inch; do. of base, 1 line; diameter of base, 6 lines; height of 1st radials, 2 lines; width, 3½ lines.

This fine species was figured, in 1847, by Prof. L. P. Yandell and the author of this paper, in a small pamphlet, entitled "Contributions to the Geology of Kentucky;" but the figures were badly executed, and unaccompanied by either a description or name. It presents the anatomical structure of that group of the genus *Actinocrinus* upon which S. Casseday has founded the genus *Batocrinus*, which really does not differ from *Actinocrinus* of Miller, except that it possesses a greater number of anal plates. In *Actino-triacontadactylus*, the typical species of the genus, and in those species figured by De Koninck and Le Hon, we find only six anal pieces; but in *A. Yandelli*, *A.* (*Batocrinus*) *icosidactylus*, and several other American species of *Actinocrinus*, the number is increased, and varies from nine to eleven.

Formation and localities.—It occurs at Button Mould Knob, 7 miles south of Louisville, Kentucky, near the base of the Carboniferous System, in blue and yellow marly clay, associated with *Productus punctatus*, *Chonetes Shumardiana*, *Orthis Michelini*, *Spirigera Roissyii*, and *Cyathoxonia cynodon*. I have, also, found silicified specimens of this species, occupying the same geological position, at White's Creek Springs, a few miles from Nashville, Tennessee.

The species is named in compliment to my friend, Prof. L. P. Yandell, of Louisville, Kentucky, whose valuable cabinet is rich in beautiful examples of it.

HOMOCRINUS POLYDACTYLUS. (*Shum.*)

Pl. I. Fig. 6, *a*, *b*.

Syn., CYATHOCRINITES. Christy's "Letters on Geology," *Pl. I, No.* 7, & *Pl.* 3, *No.* 1.

The *summit* of this species is conical, the plates moderately thick, smooth, and without exterior ornament.

The *base* is a little cup, composed of five small pentagonal pieces, a little higher than wide. A narrow, flattened band surrounds the exterior border of each plate, within which the surface is tumid, so that the base, when viewed from below, presents a distinct pentalobate outline. The articular facet for the column is pentagonal, and its diameter equal to about three-fourths the height of the base.

The *sub-radial pieces* are somewhat regularly hexagonal, a little higher than wide, larger than the basal pieces, tumid, and marked above, on either side, by a broad, obscure ridge, which crosses the sutures to unite with similar ones on the lower part of the radial plates.

The *radial plates* alternate with the last, and amount to 5 or 6 in each row, the whole number being from 25 to 27. The 1st radials are pentagonal, about one-third wider than high, and their upper edges wide. The 2d, 3d, and 4th radials have the width of the 1st radials, but they are very short, slightly convex, and quadrangular; the 5th is pentagonal, very short, and supports on its upper oblique edges two rows of brachial pieces, of which there are 5 in each row, 4 of them being quadrangular, transverse, and the 5th, or superior one, short pentagonal. This last is an axillary piece, and bears on its upper exterior edge a slender arm, consisting of a number of small quadrangular pieces, in a single series extending to the summit; the ray reposing on the inner edge is several times bifurcated.

The *anal pieces* amount to 8 or 10 in number. The 1st, which rests on the base, is heptagonal, with sides nearly equal, rather tumid, and somewhat larger than the sub-radial pieces. It bears on its upper, straight edge a smaller hexagonal piece, which supports two pieces of unequal size, one hexagonal, the other elongate quadrangular and very small. These again are succeeded by several smaller pieces which are variable in form.

Arms.—The number of ultimate rays is from 40 to 50.

Column.—A small fragment, only, of the column is known, consisting of alternate, moderately thick and thin joints, the superior one pentagonal, the others circular.

Dimensions.—Height of calyx below the free arms, 4 lines; diameter, 4 lines; height of base, 1⅓ lines; diameter, 2¼ lines; height of sub-anal pieces, 2 lines.

I have referred this species to the genus Homocrinus, founded by Prof. Hall to receive some Silurian crinoids, that are very nearly related to Poteriocrinus of Miller. It was first discovered by Prof. David Christy, of Oxford, Ohio, and figured by him, in 1848, in his "Letters on Geology;" but no specific name was applied to it. The calyx of *Homocrinus polydactylus* resembles that of *H.* (*Poteriocrinus*) *gracilis*, Hall; but it possesses a much greater number of arms, and the plates of which they are composed are much wider and shorter.

Formation and localities.—It occurs very abundantly in the vicinity of Richmond, Indiana, in bluish-gray limestone, of the age of the Hudson River Group of the New-York System. I owe to the kind attention of Mr. Christy a remarkably fine slab from this locality, which contains more than a dozen examples of this beautiful encrinite. I found a single specimen of it, in the same geological position, at Oxford, Ohio.

Poteriocrinus Missouriensis. (*Shumard.*)

Synonym.—Poteriocrinus LONGIDACTYLUS. *Ib.*, Geol. Surv. of Missouri, 2 Rep., Part II., p. 188, pl. B, fig. 5, *a*—*c*. (*Non Austin Crinoid, pl.* 11, *fig.* 3.)

When I published my description of *Poteriocrinus longidactylus*, in the Missouri Geological Report, I overlooked the fact, that Austin had described and figured a species from the Carboniferous Limestone of Clevedon and Somerset, England, under the same name. As our fossil appears to be quite distinct from the European species, it becomes necessary to give it a new name. I therefore propose, now, to designate it as *P. Missouriensis.*

EXPLANATION OF PLATE I.

Fig. 1. DICHOCRINUS CORNIGERUS, specimen four times enlarged.
- *a*. View of the anterior side.
- *b*. View of the anal side, showing the large anal piece surmounted by the smaller ones, and the anal opening.
- *c*. Basal view.

Fig. 2. DICHOCRINUS SIMPLEX, specimen natural size.
- *a*. View of the anal side.
- *b*. Basal view.

Fig. 3. DICHOCRINUS SEX-LOBATUS, specimen natural size.

Fig. 4. ACTINOCRINUS YANDELLI, specimens of the natural size, from Button Mould Knob, near Louisville, Kentucky.
- *a*. Profile view of an individual, with the proboscis attached.
- *b*. Basal view of another example.
- *c*. Structure of the calyx of same, exhibiting the disposition and form of the different species.

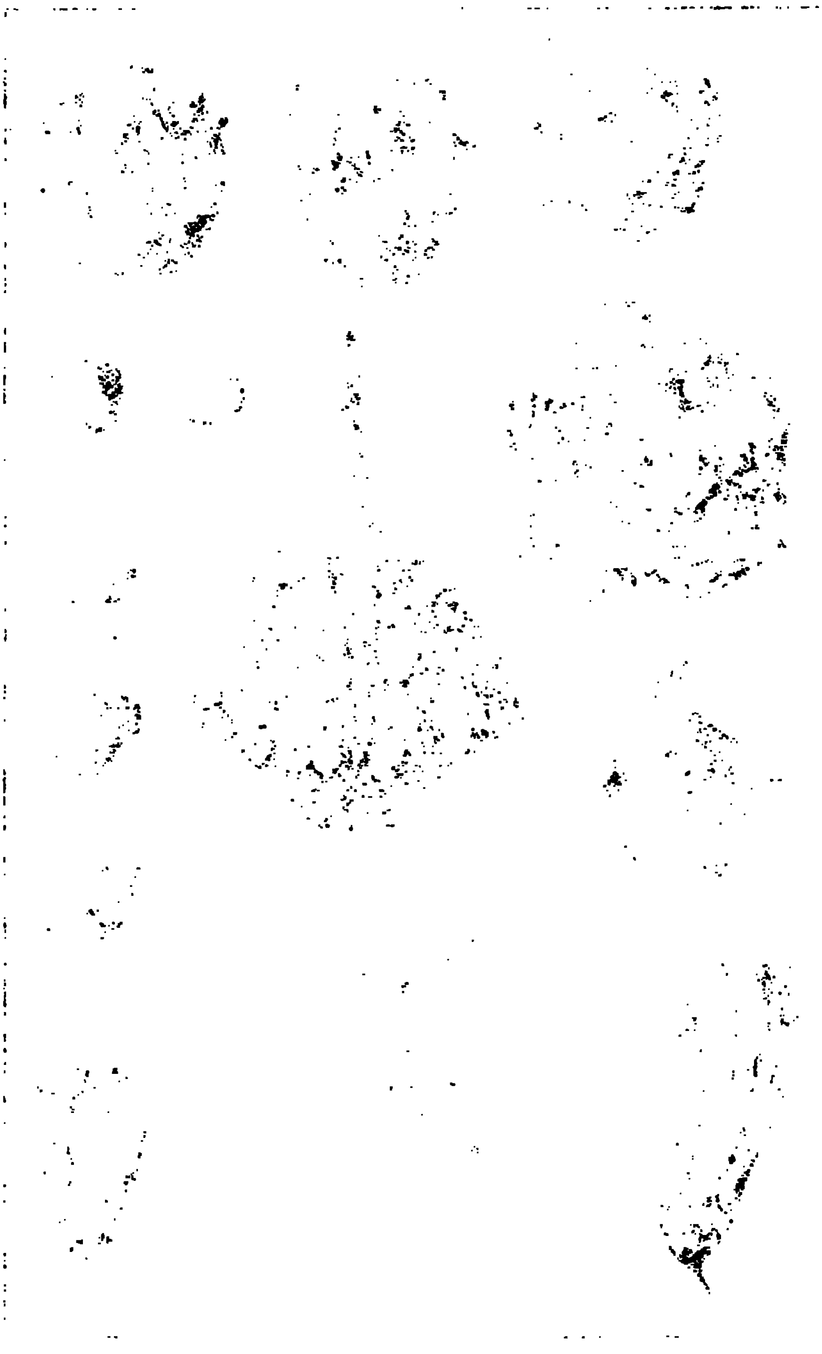
Fig. 5. ACTINOCRINUS MULTIRADIATUS, specimen from Quincy, Illinois, natural size.

Fig. 6. HOMOCRINUS POLYDACTYLUS.
- *a*. Specimen from Richmond, Indiana, natural size, partially restored.
- *b*. Anal view of a specimen from Oxford, Ohio, enlarged.

IX. *Belcher & Brother's Artesian Well.* By A. LITTON, M.D. (*Plate V.*)

Few explorations in our city, or even State, excite greater interest, and furnish stronger evidence of individual enterprise and liberality, than the Artesian Well at the Sugar Refinery of Messrs. Belcher & Brother. A work so expensive, that has penetrated the crust of the Earth to the depth of 2199 feet—that was commenced and completed at the expense, not of Government, but of individuals—merits some notice, and deserves that greater publicity should be given to the records of the Journal of its boring.

This well was commenced in the St. Louis Limestone, which is one of the upper members of the Carboniferous or Mountain Limestone, and separated from the superincumbent Lower Coal Series by a Ferruginous Sandstone, at a point about 520 feet above the level of the sea. It was originally undertaken merely with the intention of excavating a well, into which it was hoped



days were lost in making necessary repairs, it had been sunk 848 feet deeper, making its total depth 2199 feet. Since August, 1856, the first 456 feet of the well have been tubed with a three inch wrought-iron pipe, and, at the time of inserting this, it was found that the water would rise to a height of about 75 feet above the surface.

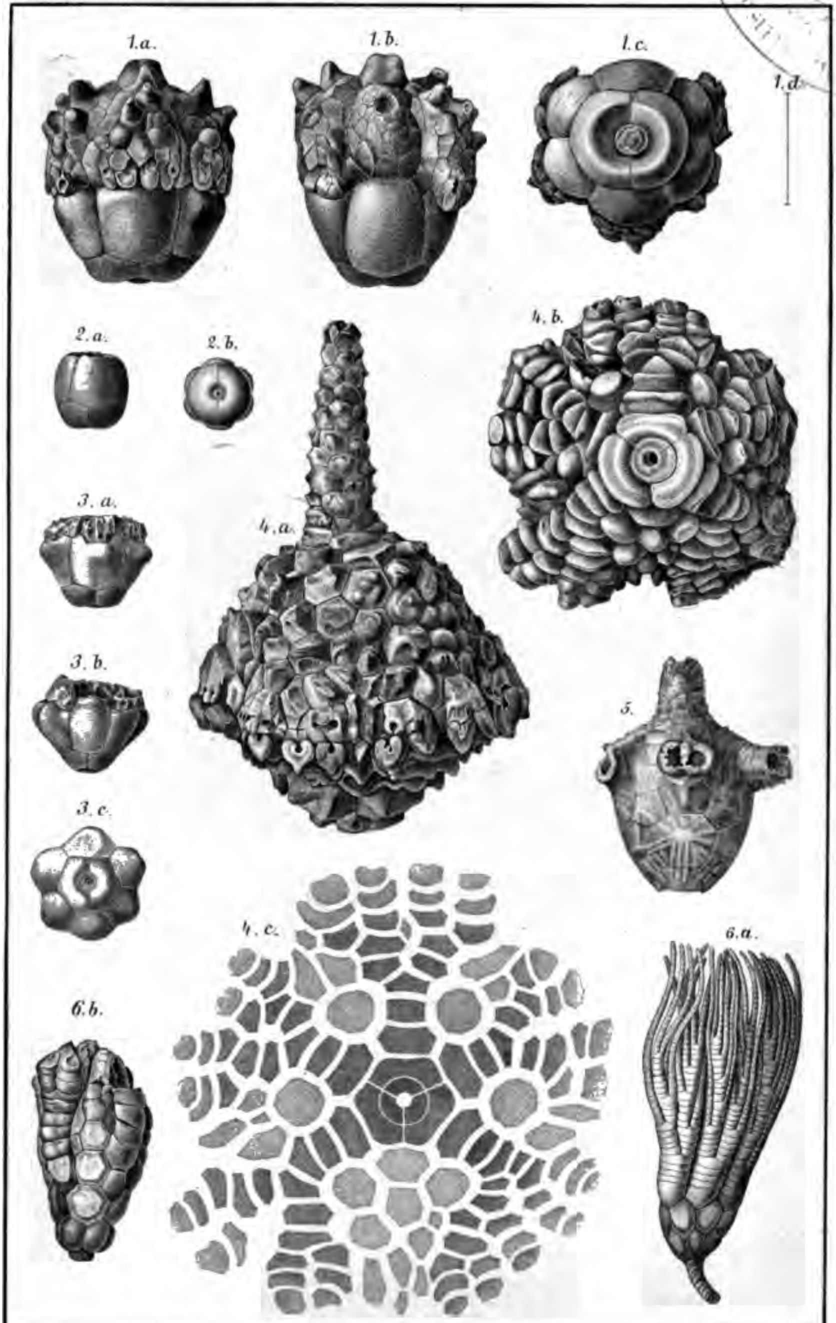
Carburetted hydrogen was first perceived in passing the thin Shale at a depth of 457 feet, and was found to increase in penetrating the soft Shales at the depth of 650 feet and the Red Marl beneath, to augment in passing the Shale at the depth of 885, and to be evolved most abundantly in passing the Bituminous Marl at the depth of 950 feet. This stratum of Marl was found to be very bituminous, and the borings, when heated, evolved much carburetted hydrogen, leaving a clay colored by the oxyde of iron. At the depth of 1090 feet the quantity of gas was found to diminish, and this diminution continued to the depth of 1135 feet. At the depth of 1183 feet it began again to increase, and became still more abundant at the depth of 1222 feet. At the depth of 1270 feet it diminished in quantity; but, at 5 feet below, it began again to increase, while at the depth of 1301 feet its quantity was observed to diminish.

Sulphuretted hydrogen was first observed at the depth of 1510 feet, and the water was then found to be strongly impregnated with it.

At the depth of 610 feet the water was first discovered to have a saline taste, and at 849 feet this property was found to be more marked, the water at that depth, upon evaporation, leaving a residue of 1½ percentage of solid constituents. At the depth of 1015, the quantity of these was found increased to 2½ per cent. At 1187 feet the percentage of salts in solution was found to have diminished, 1 ℔ of water on evaporation leaving only 148 grms.; but at the depth of 1230 ft. the percentage was found to be about three.

The boring was effected by a simple wedge-shaped drill, the size of which varied according to the diameter of the bore. This drill was screwed to a wrought-iron bar, 30 feet long, and about 2½ inches in diameter, the total weight of which was about 600 ℔s. To the bar was screwed a pair of slips (Fig. 5 of the accompanying section), by which arrangement the drilling was effected by the weight of the bar alone. To this was fastened the poles, each about 30 feet long (with male and female screws), made of two pieces of split hickory jointed and riveted in the centre. To the last poles was fastened one end of a chain, the other end of which was attached to a spring beam worked by a steam engine running with a speed of about 80 revolutions in a minute, and a stroke of 14 inches. The boring apparatus was constantly turned by hand power, and, for performing all the work connected with the boring, the labor of four men was, in general, daily required.

Such is the history of the boring of the well, as gathered from



Pauline Roetter del. L. Gast & Bro. lith. St. Louis.

that the water of the Mississippi, distant about 300 feet, would find an entrance, and from which reservoir an abundant supply of this most necessary substance might be obtained, independently of the City Water-Works, for the wants of the Refinery. Accordingly, in 1848, a conical excavation (the upper diameter of which was 12 feet, and the lower, 6 feet) was sunk to the depth of 30 feet, and though water was obtained, it was found to be hard in its properties, resembling more that of the wells than of the river, and unsuited to the wants of the Refinery; and as the height to which it rose was never that of the Mississippi, it is scarcely probable it came from this last by percolating through the intervening stratum of limestone.

In the spring of 1849, the Artesian Well proper, with a bore of 9 inches in diameter, was commenced, and was prosecuted during eighteen months with hand power only; but, as the rock was cherty and hard to penetrate, at the end of that period, only 219 feet of rock had been bored through, and the total depth of the well was then 249 feet.

In September, 1850, steam power was first employed, and used to the termination of the work, and the boring was prosecuted until February 7th, 1851, with such intermission only as was requisite for unavoidable repairs. Though 42 days were thus lost, during these five months 208 feet of rock were pierced, and the total depth of the well was then 457 feet. The character of the strata passed through, and the thickness of each, as recorded in the Journal, will be seen by reference to the accompanying section.

From February 7th, 1851, to September 29th, 1851, the work was intermitted; but at the latter date the prosecution of the work was commenced with a bore of 3½ inches in diameter, and continued until March 22d, 1852; the boring being carried on, night and day, from November 18th, 1851. On March 22d, 1852, the well had been sunk to the depth of 1351 feet, and during this period of nearly six months 894 feet had been penetrated. From March 25th, 1852, to April 30th of the same year, was occupied in widening the bore of the first 80 feet of the well from 9 to 16 inches in diameter; which accomplished, a large pump was inserted with a view of determining the quantity of water then furnished, but the results of the experiment proved unsatisfactory.

From September 1st, 1852, some weeks were employed in widening the 3½ inch bore of the well to a diameter of 5½ inches, from the depth of 457 feet to that of 1050 feet, in order to insert a four inch tube of 150 feet in length, to prevent the caving in of the shales that were found from 900 to 1050 feet, which had proved a source of great trouble, and in a measure had prevented the prosecution of the work.

On January 6th, 1853, the prosecution of the work was recommenced with a bore of 3½ inches in diameter, and continued up to March 11th, 1854; during these fourteen months, though 120

6

days were lost in making necessary repairs, it had been sunk 848 feet deeper, making its total depth 2199 feet. Since August, 1856, the first 456 feet of the well have been tubed with a three inch wrought-iron pipe, and, at the time of inserting this, it was found that the water would rise to a height of about 75 feet above the surface.

Carburetted hydrogen was first perceived in passing the thin Shale at a depth of 457 feet, and was found to increase in penetrating the soft Shales at the depth of 650 feet and the Red Marl beneath, to augment in passing the Shale at the depth of 885, and to be evolved most abundantly in passing the Bituminous Marl at the depth of 950 feet. This stratum of Marl was found to be very bituminous, and the borings, when heated, evolved much carburetted hydrogen, leaving a clay colored by the oxyde of iron. At the depth of 1090 feet the quantity of gas was found to diminish, and this diminution continued to the depth of 1135 feet. At the depth of 1183 feet it began again to increase, and became still more abundant at the depth of 1222 feet. At the depth of 1270 feet it diminished in quantity; but, at 5 feet below, it began again to increase, while at the depth of 1301 feet its quantity was observed to diminish.

Sulphuretted hydrogen was first observed at the depth of 1510 feet, and the water was then found to be strongly impregnated with it.

At the depth of 610 feet the water was first discovered to have a saline taste, and at 849 feet this property was found to be more marked, the water at that depth, upon evaporation, leaving a residue of 1¾ percentage of solid constituents. At the depth of 1015, the quantity of these was found increased to 2¾ per cent. At 1187 feet the percentage of salts in solution was found to have diminished, 1 ℔ of water on evaporation leaving only 148 grms.; but at the depth of 1230 ft. the percentage was found to be about three.

The boring was effected by a simple wedge-shaped drill, the size of which varied according to the diameter of the bore. This drill was screwed to a wrought-iron bar, 30 feet long, and about 2¾ inches in diameter, the total weight of which was about 600 ℔s. To the bar was screwed a pair of slips (Fig. 5 of the accompanying section), by which arrangement the drilling was effected by the weight of the bar alone. To this was fastened the poles, each about 30 feet long (with male and female screws), made of two pieces of split hickory jointed and riveted in the centre. To the last poles was fastened one end of a chain, the other end of which was attached to a spring beam worked by a steam engine running with a speed of about 80 revolutions in a minute, and a stroke of 14 inches. The boring apparatus was constantly turned by hand power, and, for performing all the work connected with the boring, the labor of four men was, in general, daily required.

Such is the history of the boring of the well, as gathered from

the Journal of daily work kept by Mr. Louis Holm, and from some additional notes furnished by him. It was properly commenced in the spring of 1849, and the present depth was reached on the 12th of March, 1854, about five years after the commencement of the work. During these five years the work was, at periods, intermitted for months, so that the time actually employed was only 33 months, during which, it was sunk to the depth of 2199 feet, at a cost of not less than $10,000. The depth of the Artesian Well, at Grenelle, is 1797, which required about eight years for completion, and cost over $30,000.

Though it be difficult to determine, from the borings, with absolute certainty, the geological position of the different strata penetrated, we think there is but little doubt, that the Red Marls and Shales, penetrated at the depth of 650 feet, are the same as those exposed ¾ of a mile west of the Sulphur Spring, on the Pacific Railroad, and which are classed as *Chemung* in the Geological Report of Missouri; and that the soft white sandstone, penetrated at the depth of 1505 feet, is the Saccharoid Sandstone. Taking these points as established, the strata have been geologically classified as represented on the section by Dr. B. F. Shumard, who has had opportunities, during his connection with the State Geological Survey, of becoming familiar, by personal observations, with nearly all the strata represented.

The observations made during the sinking of the well showed that the main supply of water was obtained in the soft white sandstone at the depth of 1515 feet; and from experiments since made by Mr. Holm, by passing a tube to the depth at which the main supply of water was obtained, he thinks there is no water which rises to the surface from the strata below this sandstone. This Saccharoid Sandstone is very porous, and is exposed in the counties to the west and south of St. Louis, at which points the general dip of the rocks is to the east and north. It is then, in all probability, the water-bearing stratum, in which is accumulated that portion of the water deposited from the atmosphere in the form of rain and snow, and not carried off in streams and rivers, nor appropriated to the nourishment of vegetables, nor returned to the atmosphere by evaporation. This portion of the unappropriated water, sinking into the exposed edges of the Saccharoid Sandstone, and the permeable strata above, finds a ready passage beneath the rocks on which St. Louis stands. Though these exposures are geographically higher than St. Louis, the water is incapable of percolating through the impermeable strata of shales, and rising, in obedience to the laws of hydrostatic pressure, to the same height as its source. When, however, these impermeable shales are pierced, as at the Artesian Well, then the accumulated water can escape, and will ascend to the same height as the level of the fluid in the water-bearing stratum, which, according to Mr. Holm's experiment at the Artesian Well, must be some 75 feet above the ground on which the Refinery stands. It would be in-

days were lost in making necessary repairs, it had been sunk 848 feet deeper, making its total depth 2199 feet. Since August, 1856, the first 456 feet of the well have been tubed with a three inch wrought-iron pipe, and, at the time of inserting this, it was found that the water would rise to a height of about 75 feet above the surface.

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the Journal of daily work kept by Mr. Louis Holm, and from some additional notes furnished by him. It was properly commenced in the spring of 1849, and the present depth was reached on the 12th of March, 1854, about five years after the commencement of the work. During these five years the work was, at periods, intermitted for months, so that the time actually employed was only 33 months, during which, it was sunk to the depth of 2199 feet, at a cost of not less than $10,000. The depth of the Artesian Well, at Grenelle, is 1797, which required about eight years for completion, and cost over $30,000.

Though it be difficult to determine, from the borings, with absolute certainty, the geological position of the different strata penetrated, we think there is but little doubt, that the Red Marls and Shales, penetrated at the depth of 650 feet, are the same as those exposed ¼ of a mile west of the Sulphur Spring, on the Pacific Railroad, and which are classed as *Chemung* in the Geological Report of Missouri; and that the soft white sandstone, penetrated at the depth of 1505 feet, is the Saccharoid Sandstone. Taking these points as established, the strata have been geologically classified as represented on the section by Dr. B. F. Shumard, who has had opportunities, during his connection with the State Geological Survey, of becoming familiar, by personal observations, with nearly all the strata represented.

The observations made during the sinking of the well showed that the main supply of water was obtained in the soft white sandstone at the depth of 1515 feet; and from experiments since made by Mr. Holm, by passing a tube to the depth at which the main supply of water was obtained, he thinks there is no water which rises to the surface from the strata below this sandstone. This Saccharoid Sandstone is very porous, and is exposed in the counties to the west and south of St. Louis, at which points the general dip of the rocks is to the east and north. It is then, in all probability, the water-bearing stratum, in which is accumulated that portion of the water deposited from the atmosphere in the form of rain and snow, and not carried off in streams and rivers, nor appropriated to the nourishment of vegetables, nor returned to the atmosphere by evaporation. This portion of the unappropriated water, sinking into the exposed edges of the Saccharoid Sandstone, and the permeable strata above, finds a ready passage beneath the rocks on which St. Louis stands. Though these exposures are geographically higher than St. Louis, the water is incapable of percolating through the impermeable strata of shales, and rising, in obedience to the laws of hydrostatic pressure, to the same height as its source. When, however, these impermeable shales are pierced, as at the Artesian Well, then the accumulated water can escape, and will ascend to the same height as the level of the fluid in the water-bearing stratum, which, according to Mr. Holm's experiment at the Artesian Well, must be some 75 feet above the ground on which the Refinery stands. It would be in-

Determination of total weight of solid constituents.

500 grms. of the water, to which had been added 1.981 grms. pure Carbonate of Soda, were evaporated in a platinum capsule of to dryness, and heated to the 150° C., gave for total weight of solid constituents 4.3955; in which was found .0012 gramme of Silica.

Taking the mean of these determinations, we deduced that the water of the Artesian Well contains

	In 1000 parts.	In 1 lb. Avoirdupois.
Carbonate of Protoxide of Iron,	.0094	.0658 grain.
Carbonate of Lime,	.1898	1.3286
Carbonate of Magnesia,	.0182	.1274
Chloride of Calcium,	.4964	3.4748
Chloride of Magnesium,	.6846	4.7922
Sulphate of Lime,	.8156	5.7092
Chloride of Potassium,	.1608	1.1256
Chloride of Sodium,	6.2752	43.8264
Silica,	.0024	.0168
Sulphuretted Hydrogen,	.014056	.098392
Free Carbonic Acid,	.0552	.3864
Total,	8.721656	61.051592 grs.
Direct determination of solid constit.,	8.7910	61.5370

No determinations of other gaseous constituents than the Carbonic Acid and Sulphuretted Hydrogen were made, for the want of an accurate eudiometer.

NOTE.—The elevation of the point, at which the well was commenced, above the level of the sea, was about 420 feet, instead of 520 feet, as stated at the commencement of this article (p. 80).

METEOROLOGICAL OBSERVATIONS FOR 1856, MADE IN ST LOUIS,* BY DRS. ENGELMANN AND WISLIZENUS.

MONTHS.	BAROMETER, Reduced to Freezing Point.				THERMOMETER. (Fahrenheit.)					EVAPORATION.† Monthly mean.	RELATIVE HUMIDITY.‡ Monthly mean.	QUANTITY OF RAIN AND SNOW. Monthly mean in inches.	PREVAILING WINDS. Monthly mean.	CLEARNESS OF SKY.‖ Monthly mean.	THUNDERSTORMS.
	Monthly mean of daily observations at 7, 2 and 9 o'clock.	Highest.	Lowest.	Range.	Monthly mean of daily observ. at 7, 2 & 9.	Monthly mean of daily observations at sunrise and 2 P. M.	Highest.	Lowest.	Range.						
Jan.	29.621	30.062	29.082	0.980	20.1	20.0	51.5	—13.5	65.0	1.9	73	**1.03**	W.	4.3	
Feb.	29.467	29.944	28.887	1.057	26.6	26.9	55.0	**—15.0**	**70.0**	2.0	77	3.64	W. & S.	4.2	
Mar.	29.556	29.909	29.246	0.663	36.2	36.1	65.5	15.0	50.5	4.4	59	1.06	W. & N.	5.3	1
April	29.391	29.825	28.965	0.860	59.3	58.7	88.0	34.5*	53.5	9.4	**48**	**6.35**	S. & W.	6.4	6
May	29.447	29.736	29.089	0.647	66.2	65.2	92.0	45.0	47.0	8.2	59	3.03	W. & E.	6.1	4
June	29.459	29.710	29.261	0.449	78.5	77.2	99.0	51.0	48.0	10.2	59	1.24	S. & W.	7.1	7
July	29.509	29.768	29.180	0.588	83.5	82.1	**102.5**	63.0	39.5	10.8	59	4.61	E. & N.	4.5	4
Aug.	29.519	29.722	29.309	0.413	74.2	73.0	93.0	54.0	**39.0**	7.9	65	6.32	N. & E.	4.0	4
Sept.	29.577	29.757	29.391	**0.366**	66.3	65.8	92.0	36.0	56.0	6.7	67	3.51	W. & S.	3.0	3
Oct.	29.586	30.352	29.139	1.213	66.3	60.0	85.0	29.0	56.0	6.3	67	2.10	S. & E.	4.9	
Nov.	29.601	**30.381**	29.008	1.373	40.6	41.3	75.0	19.0	56.0	3.7	69	4.90	W. & S.	4.6	
Dec.	29.613	30.296	**28.662**	**1.634**	29.6	34.7	55.0	4.0	51.0	1.4	**84**	4.29	W. & S.	5.1	
1856.	29.529	30.381	28.662	1.719	54.0	53.4	102.5	—15.0	107.5	6.1	62	42.08	W. & S.	5.0	29

* St. Louis, Missouri, is in Latitude 38 d. 37 m. 28 s.; Longitude 90 d. 15 m. 39 s.—(Nicollet.) The elevation of St. Louis above the Gulf of Mexico is, at low water mark of the Mississippi, 375 feet; at the City Directrix, 405.5 feet; and the Barometer, used for the Meteorological Observations, was placed, during the first half of the year, at an elevation of 76 feet, and, during the second half, at an elevation of 60 feet above the City Directrix.

† Or difference between the dry and the wet bulb of the Thermometer, in the open air.

‡ Calculated from the previous column, 1 designating full saturation of the atmosphere with moisture; 50, half saturation, etc.

‖ In numbers from 0 to 10, 0 designating entire clearness of sky, 10 entire cloudiness.

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	Monthly mean of daily observations at 7, 2 and 9 o'clock.	Highest.	Lowest.	Range.	Monthly mean of daily observ. at 7, 2 & 9.	Monthly mean of daily observations at sunrise and 2 P. M.	Highest.	Lowest.	Range.						
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Mar.	29.556	29.909	29.246	0.663	36.2	36.1	65.5	15.0	50.5	4.4	59	1.06	W. & N.	5.3	1
April	29.391	29.825	28.965	0.860	59.3	58.7	88.0	34.5*	53.5	9.4	**48**	**6.35**	S. & W.	6.4	6
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July	29.509	29.768	29.180	0.588	83.5	82.1	**102.5**	63.0	39.5	10.8	59	4.61	E. & N.	4.5	4
Aug.	29.519	29.722	29.309	0.413	74.2	73.0	93.0	54.0	**39.0**	7.9	65	6.32	N. & E.	4.0	4
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Oct.	29.586	30.352	29.139	1.213	66.3	60.0	85.0	29.0	56.0	6.3	67	2.10	S. & E.	4.9	
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Dec.	29.613	30.296	**28.662**	**1.634**	29.6	34.7	55.0	4.0	51.0	1.4	**84**	4.29	W. & S.	5.1	
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* St. Louis, Missouri, is in Latitude 38 d. 37 m. 28 s.; Longitude 90 d. 15 m. 39 s.—(Nicollet.) The elevation of St. Louis above the Gulf of Mexico is, at low water mark of the Mississippi, 375 feet; at the City Directrix, 405.5 feet; and the Barometer, used for the Meteorological Observations, was placed, during the first half of the year, at an elevation of 76 feet, and, during the second half, at an elevation of 60 feet above the City Directrix.

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‡ Calculated from the previous column, 1 designating full saturation of the atmosphere with moisture; 50, half saturation, etc.

‖ In numbers from 0 to 10, 0 designating entire clearness of sky, 10 entire cloudiness.

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MORTON, S. G., M.D., Synop. of Organ. Rems. of the Cretaceous Groups, U. States. Philad., 1834, 1 vol. 8vo. *(Dep.)*

Natural Philosophy.

BOOTH, PROF. J. C., Smithson. Rep. on Recent Improvements in Chemical Arts. Wash., 1851, 1 vol. 8vo. *(Don.)*

DOC. SENATE U. S. on Manuf. of Salt. Wash., 1839, 1 vol. 8vo. *(Don.)*

DUMAS. Traite de Chimie. Paris, 1828-33, 4 vols. 8vo. *(Don.)*

LARDNER, REV. DIONYS., Treat. on Porcelain and Glass. Philad., 1834, 1 vol. 12mo. *(Don.)*

McCULLOH, PROF. R. S., Reps. from Sec. of the Treas. of Scient. Investigations in relation to Sugar and Hydrometers, under superintend. of Prof. A. D. Bache. Wash., 1848, 1 vol. 8vo. *(Don.)*

ROSE, HEINRICH, Handbh. d. analytischen Chemie. 4te. Aufl. Berlin, 1838. 2 vols. 8vo. *(Dep.)*

WEHRLE, DR. ALOIS, Lhrbch. d. Probier u. Huttenkunde. Wien, 1841, 2 vols. 8vo. Plates, 1 vol. fol. *(Dep.)*

LIEBIG, JUSTUS, Chemistry in its Application to Agricul. and Physiol. N. York, 1842, 1 vol. 4to. *(Dep.)*

BIOT, J. B., Precis Elementaire de Physique Experimentale. 3me. ed. Paris, 1824, 2 vols. 8vo.

MUNCKE, G. W., Handbch. d. Naturlehre. Heid., 1829-30, 2 vols. 8vo. *(Dep.)*

BROWN, ANDR., Phil. of Physics. N. York, 1854, 1 vol. 8vo. *(Dep.)*

GEHLER, S. S. T., Physikalisches Worterbuch. VII Bd. 1. & 2. Abth. Leips., 1833-36, 2 vols. 8vo. *(Dep.)*

GUYOT, ARNOLD. Meteorolog. Table, prepared for Smithson. Inst. Wash., 1852, 1 vol. 8vo. *(Don.)*

METEOROLOG. REGISTER, 1831-42, from Observ. of Off. Med. Dep. U. S. Army. Wash., 1851, 1 vol. 8vo. *(Don.)*

ESPY, JAS. P., Rep. on Meteorology. Wash., 1850, 1 vol. fol. *(Don.)*

CHAPPELSMITH, JOHN, Account of Tornado near New Harmony, April 30th, 1852. Wash., 1855, 1 vol. 4to. *(Don.)*

METEOROLOGISCHE BEOBACHTUNGEN der Naturforschenden Gesellschaft in Zurch. Zurch, 1837-38, 2 vols. 4to. *(Don.)*

GILLISS, LIEUT. J. W., U. S. N., Magnet. & Meteor. Obser. Wash., 1845, 1 vol. 8vo. *(Dep.)*

BACHE, A. D., Magnet. & Meteor. Observ. at Girard College, for 1840-45. Wash., 1847, 3 vols. 8vo.; 1 vol. Maps, fol. *(Dep.)*

HUMBOLDT, ALEX. v., Ueber d. Hptursachen d. Temperatur-Verschiedenheiten aufd. Erdkorper. Berlin, 1827. 1 vol 4to. *(Dep.)*

JAMES, KING OF SCOTS, TO TYCHO BRAHE. Pamphlet, 1631. *(Don.)*

GUMBEL, WM. TH., Die funf Wurfelschnit t. Landau, 1852. 1 vol. 4to. *(Don.)*

WALER, JAS. FRIED., Algebra. 5te. Aufl. v. G. Fr. Wucherer. Carlsruhe, 1810. 1 vol. 8vo. *(Don.)*

VEGA, G. FREIH. v., Logarithmisch-trigonometrisches Handb. 3te. Aufl. Leipz., 1811. 1 vol. 8vo. *(Don.)*

RISEN, ADAM, Rechnung auff der Linien und Federn. 1574. 1 vol. 12mo. *(Don.)*

BOWDITCH, NATH'L, New Amer. Pract. Navigator. N. York, 1817, 1 vol. 8vo. *(Don.)*

MORE, J. HAM., Prac. Navigator. Lond., 1791. 1 vol. 8vo. *(Don.)*

MAURY, LIEUT. M. F., U. S. N., Explor. and Sailing Directions. Wash., 1851, 4to. *(Don.)*

AMER. EPHEM. & NAUT. ALMANAC for 1858. Wash., 1855, 8vo. *(Don.)*

REPORTS U. S. COAST SURVEY, 1835. New York—1850; 1851; 1852; 1853; 1854—4 vols. 8vo. & 4 vols. 4to. *(Don.)*

WISLIZENUS, A., M.D., Mem. of Tour to New Mexico. Wash., 1848. 1 vol. 8vo. *(Don.)*

ELLET, CHAS. I., Contrib. to Phys. Geog. U. States. Part I, Mississippi Valley, (Smith. Contrib.) Wash., 1849, 1 vol. 4to. *(Don.)*

Archæology.

WHITTELSEY, CHAS., Des. of Ancient Works in Ohio. Wash., (Smith. Contrib.) 1852. 1 vol. 4to. *(Don.)*

GLIDDON, GEO. R., Ancient Egypt. Philad., 1848. 1 vol. 4to. *(Don.)*

Philosophy.

KRAUSE, K. CHRIST. FR., Anfangsgrunde d. allg. Theorie der Musik. Hgb. v. Victor Strauss. Gottingen, 1838. 1 vol. 8vo. *(Dep.)*

———, Abriss d. Æsthetik; od. d. Phil. des Schonen. Gott., 1837, 1 vol. 8vo. *(Dep.)*

———, Die Lehre vom Erkennen w. v. d. Erkenntniss. Gott. 1836, 1 vol. 8vo. *(Dep.)*

———, Vorlesungen uber d. System d. Philosophie. Gott., 1828. 1 vol. 8vo. *(Dep.)*

AHRENS, H., Cours de Psychologie. Paris, 1836-8, 2 vols. 8vo. *(Dep.)*

Statistics.

PACIFIC RAILROAD, 1st Ann. Report. St. Louis, 1851. 1 vol. 8vo. *(Don.)*

MESSAGE AND DOC. Wash., 1855. 3 vols. 8vo. *(Don.)*

STATISTICS OF U. STATES, from the 6th Census. Wash., 1841. 1 vol. fol. *(Don.)*

COMPENDIUM of 6th Census U. S. Wash., 1841. 1 vol. fol. *(Don.)*

TRANSACTIONS

OF THE

ACADEMY OF SCIENCE OF ST. LOUIS.

JOURNAL OF PROCEEDINGS.

February 23, 1857.

Vice President, Dr. A. WISLIZENUS, in the chair.

A letter was read from the Hon. Geo. P. Marsh, of Burlington, Vt., elected a Corresponding Member.

Dr. Geo. G. Shumard presented specimens of coal from the Coal Measures near Fort Smith, in Arkansas. He remarked that he had traced the rocks of the Coal Measures from Washington Co., in that State, to Fort Belknap, in Texas; and they had been found about 100 miles further southward. In the neighborhood of Fort Smith, the stratum of coal was, in some places, eight feet in thickness: the quality was good, the coal burning and coking well.

Spines of Crinoids, a Spirifer, and other fossils from the Coal Measures in Madison Co., Ills., were presented by Mr. Edward Holden; also, through Dr. Pollak, two boxes of minerals and shells from South America, by C. C. Whittelsey, Esq.

Messrs. Wm. Glasgow, Jr., John Halsall, Wm. H. Belcher, F. T. L. Boyle, and E. S. Lemoine, M.D., were elected Associate Members.

March 9, 1857.

Vice President, Dr. A. WISLIZENUS, in the chair.

Letters were read from I. A. Lapham, Esq., of Milwaukie, Wis., and from Dr. R. B. Fleming, of Mine LaMotte, acknow-

Sup. U. S. Coast Survey, severally acknowledging the receipt of the Trans. of the Academy.

W. G. Binney, Esq., Germantown, Pa., W. O. Ayres, M.D., San Francisco, Cal., Mr. Richard Dudding, Ills., H. Schœnich, M.D., St. Charles, Mo., and Prof. John Locke, Jr., were elected Correspondents.

Messrs. Henry Hitchcock, F. Holske, and J. E. Yore, were elected Associates.

May 18, 1857.

Vice Pres. Dr. A. Wislizenus in the chair.

Dr. Gregory presented a tusk of a Walrus and a Whale's tooth.

Prof. Edward Daniels, of Madison, Wis., Edward H. Beebe, Esq., of Galena, and Willard C. Flagg, Esq., of Paddock's Grove, Ills., were elected Correspondents; and Prof. J. M. Post, Rev. Wm. H. Woodward, and Messrs. Caleb Oliver and James G. Soulard, Associate Members.

June 1, 1857.

Dr. C. A. Pope in the chair.

Letters were read from the Librarian of the Univ. of Mich.; from the N. Orl. Acad. of Nat. Sci.; from the Franklin Inst., Philad.; from the Bos. Soc. of Nat. His.; from the Elliot Soc. of Nat. Hist., Charleston, S. C.; and from Prof. S. F. Baird, of the Smith. Inst.,—severally acknowledging the receipt of the Transactions of the Academy.

The Corresponding Secretary laid upon the table the N. Orleans Med. & Surg. Journal, 1857, from the Editor; the Proceed. of the N. Orleans Acad. of Nat. Sciences, Vol. I., No. 1 (2 copies); the Rep. of Sanitary Com. on Epidemic Yellow Fever, by members of the Acad., 1853 (2 copies); Rep. on Geol. Survey, by the Academy; Sketch of Gen. Andrew Jackson, by Chas. Gayarré; President's Ann. Address, 1856; and a paper on the Ouachita Coal Fields (2 copies), from the Academy.

The Committee appointed to confer with Col. A. J. Vaughan concerning the purchase of his interest in the Hayden Collection of Nebraska fossils, reported, that they had concluded the purchase of his entire interest, being one-fourth, for the very moderate sum of $400, and that the Academy was much indebted to the liberality of Messrs. George Partridge, Wm. H. Smith, and G. F. Filley, associate members, who had subscribed, each, $100 toward the accomplishment of that object. One-half of the whole collection was now in the possession of the Academy.

The thanks of the Academy were voted to the gentlemen named for their very liberal contribution.

Dr. T. C. Hilgard was authorized to procure, at the expense of the Academy, a remarkable fossil fish, that had been found in the Coal Measures, in Illinois.

Dr. Hilgard made some interesting remarks on the correspondence of the several divisions of the vertebrate skull with the vertebræ, in respect of their parts or processes, illustrating his observations from crania of various animals.

Rev. John Higginbotham, of Halifax, N. S., was elected a Correspondent, and Messrs. Wm. H. Vanderford, Edward Haren, Sen., J. S. Post, F. A. Meyer, E. Schrick, and E. Boerner, M.D., were elected Associate Members.

June 15, 1857.

The President, Dr. B. F. Shumard, in the chair.

The Jour. of the Franklin Inst., Philad., May, 1857, was received from the Society; and a copy of "Med. Statistics of the U. S. Army, 1839–54," was presented by Dr. McPheeters.

Dr. Pope read a letter from the Smithsonian Institution, recommending that the collection of specimens in Nat. History made by Capt. John Pope, U. S. Corps Top. Eng., and by letter presented to the Academy at a former meeting, should be arranged and labeled at the Institution before being forwarded from Washington. Accepted.

Specimens were presented as follows: a collection of minerals, by Dr. C. A. Pope, who, also, deposited in the Museum the mineralogical and geological collection of the late George Collier; a limestone slab, showing deep casts of mud-cracks, found underlying a stratum of sandstone, on the line of the Pacific Railroad, by Mr. J. Moss; specimens of *Cyathophyllum*, *Platyostoma*, *Dalmania tridentifera*, and *Rhynconella*, from the Delthyris Shaly Limestone, near Birmingham, Mo., by Mr. Holden; and crystals of sulphate of lime from Ellsworth, Ohio, by Mr. W. H. Barris.

Dr. Shumard stated, that he had examined, in Pulaski Co., in this State, remains of an ancient stone-wall enclosure, in the form of a parallelogram, the lines running East and West, and North and South, built of loose stones, rising some two or three feet above the general level. Within the enclosure was a single conical pile or mound of stones. It was situated on an isolated hill, near the junction of Osage Fork and Gasconade Rivers. Some ten or twelve similar mounds of stones were observed occupying a commanding position on the hills along the valley, and standing some 300 feet above the Gasconade.

Mr. Holmes observed, that similar stone mounds were mentioned by Messrs. Squier and Davis as occurring in the Scioto Valley, 12 miles West of Chillicothe; also, at Somerset, Ohio, and Beaver Creek, in Virginia. In some places the stones were vitrified by the action of fire, and it had been inferred, that these mounds had been used as signal stations in the age of the mound-builders. Such mounds were distinguishable from the stone heaps of modern Indians, covering a grave, as observed by Col. Fremont, West of the Rocky Mountains, and by others, East of the Mississippi.

Prof. D. S. Sheldon, of Iowa Coll., Davenport, and W. H. Barris, Esq., of Iowa City, were elected Correspondents, and the Hon. Samuel Reber, an Associate Member.

June 29, 1857.

Vice Pres. Dr. A. WISLIZENUS in the chair.

The Corresponding Secretary laid upon the table "Report on two New Species of N. American Helicidæ, by John H. Redfield," from the Author; the "College Jour. of Med. Science," Cin., Ohio, 1857, from the Editor; and "Catalogue of Human Crania in the Collection of the Acad. of Nat. Sciences, Philad., by J. A. Meigs, M.D., from the Author; and the Proceed. of the Acad. of Nat. Sci., Philad., March, 1857, from the Society.

Numerous mounted and preserved specimens of mammals, birds, reptiles, and fishes, collected on the Upper Missouri River by the taxidermist sent by the Academy to accompany Mr. C. P. Chouteau, on the annual trip of the Amer. Fur Co.'s boats, were received and deposited in the Museum. The thanks of the Academy were voted to Mr. Chouteau.

Dr. T. C. Hilgard remarked, on the skull of vertebrata, that there were, besides the transverse processes, five parts in each vertebral ring; and these might be traced in *five* corresponding divisions of the skull. The skull of the fish was best adapted for the display of the correspondencies of the appendages (hæmal arches); for the parts were more disjointed, and were typical of the general plan. The temporal bones belonged to the lower jaw as their coxa, but were inserted into the cranial crevices. There were five pairs of ribs in the fish corresponding to the five vertebral arches; and there were also five pairs of extremities. The transverse processes of each part could be shown in the *base* of the skull. He gave illustrations from the crania of different fishes, birds, mammals, and the infant skull.

A. L. McGregor, M.D., of Chamois, Mo., was elected a Correspondent, and Messrs. Thomas Allen and S. A. Ranlett, Associates.

July 27, 1857.

Vice Pres. Dr. Wislizenus in the chair.

The following works were received from Dr. Bennett Dowler, of New Orleans: N. Orleans Med. & Surg. Journal, July, 1857; Tableaux of Yellow Fever, New Orleans, 1853; Geographical, Commercial, Geological. and Sanitary Condition of New Orleans; Experimental Researches by Bennett Dowler; Progress of Discovery in the Nervous System, and Med. Ethics, by Bennett Dowler; and "Découverte de l'Amérique par les Normands."

Dr. T. C. Hilgard made some highly interesting remarks upon the subject of Systematic Botany, which he illustrated from botanical specimens in numerous families in the vegetable kingdom. He maintained, that a connected series throughout, from the lowest to the highest order, might be established.

Messrs. James C. Reid, Herman Kœnig, J. N. Dubarry, and Hon. John M. Krum, were elected Associate Members.

August 10, 1857.

Dr. E. H. Gregory in the chair.

Letters were read from the Lyceum of Nat. Hist., N. York, from the Amer. Acad. of Arts & Sci., and from the Albany Institute, acknowledging the receipt of the Transactions of the Academy.

The Corresponding Secretary laid upon the table the Memoirs of the Amer. Acad. of Arts & Sciences, New Ser., Vol. VI., Part I., and the Proceed. of the Amer. Acad. of Arts & Sci., Vols. I., II. & III., from the Academy; Jour. of Franklin Inst., Philad., July, 1857, and Discussion on Joints of Railways, from the Society; "Prodromus Descriptionis Animalium Evertebratorum, quæ in Exped. ad Pacificum Septen. observavit et descripsit, W. Stimpson," from the Author.

Specimens of fossil ferns, fossil wood, and coal, from the Coal Measures in Jackson Co., Ills., were presented by Mr. Edw. Holden; an Indian axe of specular iron ore, and a quoit, found in Crawford Co., Mo., by Dr. Williams; some small fragments of human bones taken from a conical stone heap on Piney Creek, in Pulaski Co., Mo., by Mr. Watkins; and a number of Indian implements from the southeastern part of the State, by N. Paschall, Esq.

August 24, 1857.

Vice Pres. Dr. Wislizenus in the chair.

Dr. Wislizenus presented a fine specimen of fossil fern from Chester, Ills.

Dr. T. C. Hilgard read a paper on "The Idea of Species." Referred to a committee.

Dr. Berthold Seeman, of London, Eng., Thos. W. Blatchford, M.D., of Troy, N. Y., and Dr. —— Williams, of Crawford Co., Mo., were elected Correspondents, and Mr. Willard F. Bliss, an Associate Member.

September 7, 1857.

The President, Dr. B. F. Shumard, in the chair.

Letters were read from Dr. Berthold Seeman, Rev. John Higginbotham, and Dr. T. W. Blatchford, acknowledging their election as Correspondents.

The Smithsonian Report was received from the Institution, and the Jour. of the Franklin Inst., Vol. LXIV., No. 380, from the Society.

Presentations were made of a beautiful specimen of nitro-ammoniuret of copper from the Stanton Copper Mines, from Mr. H. W. Leffingwell; a Lizard, from Dr. Shumard; and two crania of Assiniboin Indians, from Dr. John Evans, U. S. Geologist.

C. C. Whittelsey, Esq., made some interesting remarks upon the rocks of the shores of the St. Lawrence, and presented specimens of minerals which he had collected there.

Dr. Shumard stated that he had extended an invitation in behalf of the Academy to the Amer. Association for the Adv.

of Science, at the late meeting in Montreal, to hold its next meeting in St. Louis; that it had been well received, and might be accepted another year.

September 21, 1857.

The President, Dr. B. F. Shumard, in the chair.

The Corresponding Secretary laid upon the table the Proceed. of the Bos. Soc. of Nat. Hist., August, 1857, from the Society; Catalogue of N. Amer. Mammals, from Prof. S. F. Baird; Jour. of the Franklin Inst., Philad., Vol. LXIV., No. 381, from the Society; Proceed. of the Elliot Soc. of Natural Hist., Charleston, S. C., 1857, from the Society.

A letter was read from Prof. D. S. Sheldon, of Iowa Coll., Davenport, accompanying a suite of shells from that vicinity, and requesting an exchange. Referred to the Committee on Malacology.

Dr. Prout exhibited a specimen of abnormal growth in twelve ears of corn growing in the place of one.

Dr. B. F. Shumard read a paper entitled "Descriptions of New Species of Blastoidea from the Palæozoic Rocks of the Western States of North America; with Observations on the Structure of the genus, Pentremites." Referred to a committee.

The President read some extracts from a letter addressed to him by Prof. E. Emmons, of Albany, N. Y., dated the 15th September, 1857, by which it appeared, that Prof. Heer, of the Univ. of Zurich, Switzerland, had examined the plants figured in the Report on Geol. of N. Carolina (Part II.), and had come to the conclusion that not a single plant, either of the Richmond Coal Field, or of the N. Carolina deposits, was Jurassic, or Oolitic, as had been maintained by Rogers, Hall, Lyell, and others: and moreover, that several of them were identical with those of the Keuper, in the vicinity of Stuttgart (Würtemburg). Sir Charles Lyell, having examined the whole matter anew, relating to the age of the Virginia and N. Carolina Sandstones, with reference to the reports of Prof. Emmons and the views of Prof. Heer, had been induced to change his opinion.

The following are some of the changes indicated as necessary to be made, according to Prof. Heer, in the names of the plants mentioned in Prof. Emmons' North Carolina Report: *Pecopteris falcatus* is probably Loccopteris and resembles *L. germinans* (Geoff.) His Infra-Liassic *P. Carolinensis* is related to *Gutbieria angustiloba* (Sternb.), but is distinguished from that species by its indusium separating into more than four parts.

Loccopteris is a related genus, but has the sporocarp formed of a small number of large sporangia placed in the form of a star. Prof. Heer calls it *Gutbieria Carolinensis*. The *P. bullatus* of Bunbury is *P. Stuttgartiensis* of Brogniart, is widely spread in Europe, and belongs to the Keuper. *Neuropteris lineafolia* (Bunb.) is *Cyclopteris*, related to *C. pachyrachis* (Geoff.) *Pterozamites decussatus* (Emmons) is *P. longifolium* (Bronn), and a *Pterophyllum* is *Pter. longifolium*. *Pterozamites* is much like *Zamites distans* (Sternb.), but differs in species, at least.

Prof. Heer regards the *Walchia diffusus* not as *Lycopodium*, but as *Taxodites*, close to *T. Munsterianus*. *Calamites arenaceus*, *Strangerites obliquus*, and *Ærostichiles oblongus*, are good. The latter is the *Pecopteris Whitbyensis* so much relied upon by Rogers and Lyell as a Liassic species. They mistook the character of the side veins.

Thus the views of Prof. Emmons with regard to the Connecticut River Sandstone and the N. Carolina and Virginia Coal Series would seem to be sustained. The decision of Prof. Heer is, that the upper part, where the plants referred to occur, is Keuper of Europe, and that the mass, containing the *Dromotherium* and *Rutiodon clepsisamus*, &c., is Permian, or can not be newer than the Bunter-sandstone; and it is said, as Prof. Emmons has said before, that the *Dromotherium sylvestre* is the most ancient mammal yet discovered.

Rev. Dr. George White, of Florence, Ala., Rev. Chas. H. A. Dall, Calcutta, E. India, Sir William E. Logan, T. Sterry Hunt, Esq., and L. A. H. Latour, Esq., of Montreal, Can., Dr. Hoy, of Racine, Wis., and Prof. E. Emmons, of Albany, N. Y., were elected Corresponding Members.

October 5, 1857.

The President, Dr. Shumard, in the chair.

A letter was read from James G. Soulard, Esq., presenting to the Academy a very fine specimen of galena from the Mammoth Lead Mines of Mr. Wm. Marsden, three miles from Galena, weighing 210 lbs.; also, a letter from Lieut. F. T. Bryan, U. S. Army, accompanying the presentation of a valuable collection of mammals and reptiles (as per numbered catalogue by Mr. Wm. S. Wood), consisting of a variety of snakes, lizards, plover's egg, badger, prairie-dog, gray wolf, buffalo, striped squirrel, antelope, &c., collected along the valley of the South Platte to the Rocky Mountains, in the months of June, July, and August, 1857.

The thanks of the Academy were voted to the gentlemen named for their valuable donations.

Two cases for the Museum were presented by Mr. Spencer Smith.

Dr. Hilgard exhibited a curious specimen of an ear of corn, with several distinct ears growing around a central one, and made some remarks explanatory of the phenomenon. He, also, presented a specimen of *Nelumbium luteum*, the mythological Lotus of the Egyptians, from the American Bottom, and made some interesting observations respecting its nutritive character.

October 19, 1857.

Vice President, Dr. Wislizenus, in the chair.

Letters were read from Sir William E. Logan, Rev. George White, Prof. E. Emmons, and T. Sterry Hunt, Esq., acknowledging their election as Correspondents.

The Corresponding Secretary laid upon the table the "Taconic System, based on Observations made in N. York, Massachusetts, Maine, Vermont, and Rhode Island, by E. Emmons," presented by Dr. B. F. Shumard.

Dr. T. C. Hilgard read a paper, entitled "Exposition of a Natural Series of Immediate Catholic Affinities in the Vegetable Kingdom."

He remarked, *in limine*, that from experience it was deemed advisable to secure a just appreciation of what is actually implied, and on what terms. All representations were limited, conditionally requiring the proper key in order to be understood. Sensuous figures were required in order to render any idea fixed and transmissible. All clear definitions finally resolved themselves into sensuous images of plain meaning, implying intellectual ideas. Popular classification was according to effects and purposes; scientific classification was according to causes. A philosophic representation required both the causes and effects to be held in view: it thus became a part of popular language. The popular application of words was a record significant of innumerable observed relations. An efficient definition could be given only synthetically on the known causes. Where the actuating causes were unknown, as in the phenomena of life, description must stand foremost. The given conditions, or original first point of view, were the only safe material, because on them we could proceed conclusively as on causes. In systematic Botany, the given conditions were *individual totality* for identification and *totality of resemblance* for affinities. Botany had as yet been chiefly diagnostic. Its natural history, or rather its natural economy, had been until lately neglected. The natural groups established by the De Jussieus had stood the test of appreciation, and given the death-blow to artificial definitions. Many authors had conjectured a *serial* connection of affinities. Conjectures were the only means of arriving at an understanding of *causes;* while effects could be *deduced*. An hypothesis was required to be intuitively explicative, so as to come true in its applications. The causal truth was required to be anticipated. This was most safely done step by step, advancing from the concrete phenomena and their immediate causes into the deeper causes by suggestion. This was the inductive method. His series had been constructed by juxtaposition, according to most perfect resemblance in total. The different portions of a series thus obtained gradually became a connected series by the same process. Collateral relations were also observed in confirmation of various authors. All the natural orders found their connecting links, and, even in the most extensive ones, such as Labiatæ, Leguminosæ, &c., a corresponding intrinsic series was realizable.

The detailed expositions began with the ascertained end of the series, and followed the order obtained. Fungi were the lowest vegetable organisms, and, serially, stood at the lowest extremity. The fermentation cell, perhaps identical with that of putrefaction, was not the perfect plant. Its self-multiplication was the normal process of tissue increase. This must be kept in mind, likewise, respecting the cells of Diatomeæ, the so-called "fossil infusoria." Next to the completed forms of fermentation, or leaven, followed mould, and blight, and various epyphytes, as smut, and scall. Some were infectious diseases.

Dr. H. extended his remarks through a description of the Fungi, and illustrated them by diagrams of arranged natural specimens.

The paper was referred to a committee.

Dr. Enno Sander exhibited several preparations of Pyrophosphate of Iron, and its solutions.

The plate accompanying Dr. Shumard's paper on Pentremites was ordered to be lithographed.

November 16, 1857.

Dr. H. A. Prout in the chair.

Letters were read from W. H. Barris, Esq., and Dr. A. L. McGregor, elected Correspondents; also, a letter from Messrs. Little, Brown & Co., Boston.

The Corresponding Secretary laid upon the table the Proceed. of the Amer. Philosophical Society, Philad., Jan. to June, 1857, from the Society; and Jour. of the Franklin Inst., Oct., 1847, from the Society.

A paper from Dr. G. G. Shumard, entitled "Observations on the Geological Formation of the Country between the Rio Pecos and the Rio Grande, in N. Mexico, near the line of the 32d Parallel; being an abstract of a portion of the Geological Report of the Exped. under Capt. John Pope, U. S. Corps Top. Engineers, in the year 1855: by George G. Shumard, M.D., Geologist of the Expedition," was read by the Corresponding Secretary.

The paper was ordered to be published in the Transactions.

Some Indian beads, found 40 feet below the surface in an excavation on the line of the Railroad, near Alton, Ills., were presented by Dr. E. F. Smith, and specimens of granites and trap rock from Cape Ann, Mass., by Mr. Holden.

November 30, 1857.

Vice Pres., Dr. WISLIZENUS, in the chair.

The following works were placed upon the table: Smithsonian Rep., 1856; President's Mess. & Doc., 1856–7, Parts I. & II.; Patent Office Rep., 1856, Vols. I., II. & III.; Central Amer. Affairs & Enlistment Ques., Wash., 1857; Explor. & Surveys of Pacif. R.R. Routes, Vol. II. & III., from the Hon. L. M. Kennett; and Reports of the Society of Nat. Hist., Montreal, from the Society.

Specimens were presented for the Museum as follows: a collection of fresh-water shells from the Illinois River, fossils of various kinds, and 15 cases of Insects from California, deposited by Dr. C. A. Pope; a fine specimen of silver ore from El Paso, N. Mex., and other minerals sent to him by the late George Collier, presented by Dr. Pope; specimens of kaolin, yellow ochre, limestone from Crown Point, a slab of limestone curiously worn and polished by nature, greenstone from Nahant, shale containing fossil ferns, red jasper from Vergennes, Vt., fossil coralline from Lake Champlain, graptolite from N. York, gypsum and selenite from Nova Scotia, lignite from Rutland, Vt., and kolophonite from Willsboro, N. Y., by Mr. Spencer Smith; adipocire, by Dr. C. W. Stevens.

Mr. Edward Bühler was elected an Associate Member.

December 14, 1857.

The President, Dr. SHUMARD, in the chair.

The following works were placed upon the table: Smithsonian Contrs. to Knowl., Vol. IX., from the Institution; Proceed. of the Bos. Soc. of Nat. Hist., from the Society; Jour. of the Franklin Inst., Philad., No. 383, 1857, from the Society; N. Orleans Med. & Sur. Journal, Nov., 1857, from the editor; Trans. of the Illinois State Agricul. Soc., 1856–7, from I. A. Lapham, Esq.; Smithsonian Rep., 1855, 1856, from the Institution.

Dr. Pollak presented the Annual Rep. on the Geology of the State of Maine.

A memorial was addressed to Congress praying the publication of the Report on the Geological Survey of Oregon and Washington Territories, by Dr. John Evans, under authority of the U. S. Government.

December 28, 1857.

The President, Dr. SHUMARD, in the chair.

Letters were read from Dr. John Evans, returning his thanks for the memorial adopted, at the last meeting, in relation to the publication of his report; from E. C. Angelrodt, Esq., advising the Academy that he had received the work of Ehrenberg on Microgeology, previously ordered; from the California Acad. of Nat. Sciences, acknowledging the receipt of the Transactions of the Academy; from Mr. W. G. Binney, in reference to subscription for his work on the "Terrestrial Mollusks of the U. States."

The following works were placed upon the table: "Microgeologie," by Ehrenberg, 2 vols. fol., purchased by the Academy; "N. Amer. Deer Species," and Prospectus of Jour. from the Mississippi to the South Sea, by Möllhausen, from Mr. Angelrodt; "Contributions to the Nat. Hist. of the U. States, by Louis Agassiz, Vols. I. & II., purchased by the Academy; Proceed. of the Cal. Acad. of Nat. Sciences, 1856–7, from the Society.

Mr. Spencer Smith read a paper, entitled "An Hypothesis on the Formation of Hail." Referred to a committee.

Dr. B. F. Shumard read a paper, entitled "Description of New Fossil Shells collected from the Tertiary formation of Oregon and Washington Territories, and the Cretaceous of Vancouver's Island, by Dr. John Evans, U. S. Geologist, under instructions from the Department of the Interior." Referred to a committee.

Mr. Fred'k S. Cozzens was elected an Associate Member.

January 11, 1858.

The President, Dr. B. F. SHUMARD, in the chair.

A letter was read from the "Kais. Akad. der Wissenchaften," of Vienna, Austria, acknowledging the receipt of the Transactions of the Academy, and advising them that the "Comptes Rendus de la Classe Physique et de Math. de l'Acad. Imperiale" would be forwarded in return through the Smithsonian Institution; also, a letter from L. A. H. Latour, Esq., of Montreal, acknowledging his election as a Corresponding Member.

The N. Orleans Med. & Sur. Jour., Jan., 1858, was received from the editor.

An elegant series of models of the various forms of crystalization were presented by Mr. R. W. Bender.

Dr. A. Wislizenus read a paper containing his Meteorological Observations, at St. Louis, for the year 1857. The paper was ordered to be published in the Transactions.

The President made the following report of the progress of the Academy during the past year:

Report of the President, on the progress of the Academy during the year 1857.

MUSEUM.

The additions to the Museum, during the past year, have been unusually large in nearly all its departments. I am happy in being able to state that our Institution now possesses an equal share with the Academy of Natural Sciences of Philadelphia, in the splendid collection of fossil remains made by Dr. F. V. Hayden from the cretaceous and tertiary formations of the Mauvaises Terres of Nebraska, and other portions of the Upper Missouri country. To the generous donation of Chas. P. Chouteau, Esq., in 1856, of one-fourth of this collection, has been added another fourth, by purchase, from Col. A. J. Vaughan, U. S. Indian Agent, who, being desirous that his portion should remain in our city, consented to sell it to the Academy at a price much below its real value. And it gives me pleasure to add still further, that we are much indebted to our fellow-members, Messrs. George Partridge, William H. Smith, and Giles F. Filley, who came forward, and with great liberality at once subscribed three-fourths of the purchase price.

The Academy is again under obligations to Mr. Chas. P. Chouteau for valuable and extensive donations in several of the departments of natural history, from Nebraska and the adjacent Indian Territory.

We are also largely indebted to the following gentlemen for highly important contributions to the Museum:

To Capt. John Pope, of the United States Corps of Topographical Engineers, for an extensive and unique collection of fossils from the carboniferous and cretaceous systems of Texas and New Mexico; among which are a number of species that are entirely new to science, and for numerous specimens in Herpetology from the same districts of country. To Lieut. Bryan, United States Corps of Topographical Engineers, for a choice suite of reptiles, and skulls and skins of Mammals, from the Platte River country, and the base of the Rocky Mountains. To Spencer Smith, Esq., for interesting minerals and fossils from various parts of the United States, and to Prof. Chas. A. Pope, for large additions to the Entomological cabinet, and for a number of rare minerals.

The different departments of the Museum have received the following donations during the year that has just passed:

Mammalia.—Of this class, nicely preserved skins of thirteen species, and twenty-five individuals, have been presented, chiefly from Lieut. Bryan and Charles P. Chouteau, Esq. A number of these have already been mounted and placed in the cabinet.

Ornithology.—Of birds we have not received as large additions as during the year previous; nevertheless, quite a number of fine specimens from the Upper Missouri have been presented by Mr. Chouteau; and others have been procured from the same region through our taxidermist.

Reptilia.—In this class the cabinet has received rich accessions during the past year. Captain John Pope has presented a large series of reptiles, collected by him during his explorations for the United States Government in Texas and New Mexico. These are now in the hands of Professor Baird, of the Smithsonian Institution, who has volunteered to examine and classify them for us. Lieut. Bryan has donated eighteen specimens of reptiles belonging to thirteen species, from Kansas, Nebraska, and the Rocky Mountains. Mr. Charles P. Chouteau has added largely to his previous donations in herpetology, from the region of the Upper Missouri. Specimens from our own State have been presented, chiefly by Dr. West, of Jefferson county, by Prof. Pope, Dr. A. L. McGregor, of Chamois, and Mr. Belcher.

Comparative Anatomy.—In this department a number of skulls of Mammals have been received, chiefly from Mr. Chouteau and Lieut. Bryan. Dr. Evans, United States Geologist, has presented two skulls of Assiniboin Indians, and Dr. G. G. Shumard an interesting compressed human skull, taken from an Indian mound in Arkansas.

Entomology.—Dr. Pope has enriched this department of the Museum by a deposit of fifteen cases of insects from California.

Mollusca.—In this class there have been received from Dr. McPheeters a collection of marine shells, chiefly from the South Pacific Ocean; from Dr. Pope, fresh-water shells from Illinois; and from D. S. Sheldon, specimens of the same from Iowa.

Botany.—But few additions have been made to the herbarium; some specimens of fossil ferns and woods from Illinois were presented by Eddward Holden, Esq.

Palæontology.—The increase in this department of the Museum, during the past year, is in the highest degree encouraging. In addition to the acquisition of one-fourth of the Hayden collection, and the donation, by Capt. Pope, of a large collection of fossils from Texas and New Mexico, already spoken of, there have been presented an entire case of fossils from the palæozoic rocks of the Mississippi Valley. This collection is now ready to be placed in the Museum as soon as the case, which has been ordered by the Academy to receive it, shall be completed. C. P. Chouteau, Esq., has presented cretaceous fossils from Nebraska, and Messrs. Spencer Smith, Edward Holden and Drs. Wislizenus and Pope, palæozoic fossils from other Western localities.

Mineralogy.—In this class large additions have also been made to the cabinet. C. C. Whittelsey, Esq., has presented a suite of minerals from South America, and specimens of rocks from Canada. Spencer Smith, Esq., a handsome series of specimens from Vermont and other localities, in the United States. Prof. Pope has given us, from time to time, choice minerals, and among the rest a beautiful specimen of silver ore from El Paso. He has also deposited with the Museum the mineral cabinet of the late Geo. Collier, Esq. Jas. G. Soulard, Esq., has donated a magnificent specimen of galena from Illinois; and other minerals have been presented, chiefly by Mr. Moss and Dr. G. G. Shumard.

Chemistry.—Of chemicals, a number of specimens have been presented by Dr. Enno Sander.

Ethnology.—In this department, we have received from Dr. Wm. M. Mc Pheeters, implements of war, and articles of costume, from the Sandwich Islands. From N. Paschall, Esq., a box, containing a variety of Indian implements and antiquities. From Dr. C. W. Stevens, a head-dress, quiver and arrows of a Comanche Indian; and from Dr. E. F. Smith, a string of Indian beads, found forty feet beneath the surface in Illinois.

Library.—The total number of additions to the Library since our last anual meeting amount to ninety-seven, of which twenty-five are volumes, and the remainder serials and pamphlets. Most of these have been obtained in exchange for the Transactions of our Academy and as donations, chiefly from the Hon. L. M. Kennett and E. C. Angelrodt, Profs. Spencer F. Baird and Wm. M. McPheeters, and I. A. Lapham, Esq., of Milwaukie, Wisconsin. Among the most valuable acquistions received, we may mention the magnificent work of Ehrenberg on Microgeology; the first two volumes of Agassiz' Contributions to the Natural History of the United States; the publications of the Smithsonian Institution; the Reports of the U. S. Coast Survey, and the Proceedings of the American Academy of Arts and Sciences.

Transactions.—It is extremely gratifying to know, that the first number of our Transactions has been very favorably received by the scientific public. Complimentary acknowledgments have reached us from many of the learned societies, both at home and abroad, and we are now regularly receiving all the most prominent American scientific publications in exchange for ours. Most of them are of the highest value to students of Natural History, and could only be procured by purchase at a cost beyond the means of most private individuals.

Through the politeness of Profs. Henry and Baird of the Smithsonian Institution, and our associates Mr. E. C. Angelrodt and Dr. Engelmann, copies of our Transactions have been distributed to different foreign scientific societies and libraries, free of cost. From some of them we have already received advices that valuable publications have been sent to us, and we may reasonably expect equally valuable returns from others, during the present year.

In view of the utility and acknowledged want of a scientific library in our city, it is of the first importance that we should continue the publication of the Transactions of the Academy at regular intervals—say one number annually. By this means, we shall continue to receive the journals and transactions of foreign and home institutions, the value of which will alone thrice exceed the cost of our publications. It may be here mentioned, that while there are many extensive and excellent scientific libraries in the Eastern cities, some of which, if lost, could not be replaced in a century, there is not a single one in the broad valley of the Mississippi. Hence it is, that persons residing in the West, who are disposed to pursue original investigations in science, must look to libraries of the East for their works of reference, and thus they are compelled to labor under many disadvantages. It should, therefore, be one of the principal features of our Institution to collect together, as rapidly as possible, a library of scientific journals and transactions; and this desirable end is to be accomplished, mainly, through its exchanges and donations.

Scientific Papers.—Besides numerous verbal communications of more or less interest, there have been presented, during the past year, the following scientific papers for publication in the Transactions:

By Dr. Theodore C. Hilgard.—"Exposition of the Natural Series, Divisions, Affinities, and Formal Expressions, of Typical Laws in the Vegetable Kingdom;" also, "On the Idea of Species."

By Dr. B. F. Shumard.—"Descriptions of New Species of Blastoidea, from the Palæozoic Rocks of the Western States of North America, with Observations on the Structure of the Genus Pentremites;" and "Descriptions of New Fossil Shells collected from the Tertiary Formation of Oregon and Washington Territories, and the Cretaceous of Vancouver's Island, by Dr. John Evans, U. S. Geologist, under instructions from the Department of the Interior."

By Dr. G. G. Shumard.—"Observations on the Geological Formation of the Country from the River Pecos to the Rio Grande, in New Mexico, near the line of the thirty-second Parallel, being an Abstract of a portion of the Geological Report of the Expedition under Capt. John Pope, Corps of Topographical Engineers U. S. A., in the year 1855."

By Spencer Smith.—"An Hypothesis on the Formation of Hail."

By Dr. Wislizenus.—"Meteorological Observations at St. Louis."

Treasury.—From a communication from Dr. Pollak, Treasurer, I am happy in being able to state that our Treasury is in a very sound condition. Our receipts during the year have been $1,378.45; expenditures, $1,071.58; leaving a balance in the Treasury of $306.87. Our liabilities are $437, and our assets $788.87. Balance in favor of the Treasury, $381.87.

In conclusion, permit me to remark that we have reason to feel proud of the unparalleled growth of our young Institution. Scarcely has a period of two years elapsed since the first specimen in Natural History was deposited in this Hall; and we now possess a Museum that far surpasses, in the number and value of its objects, that of any similar institution in the West, though some are of many years' standing.

The Report of the Treasurer was read, and referred to a committee for examination.

Officers for the ensuing year were elected as follows:

President,	Benjamin F. Shumard.
1st Vice President,	Adolphus Wislizenus.
2d Vice President,	Hiram A. Prout.
Corresponding Secretary,	Nathaniel Holmes.
Recording Secretary,	J. S. B. Alleyne.
Treasurer,	Simon Pollak,
Librarian,	Theodore C. Hilgard.
Curators,	B. F. Shumard, C. W. Stevens, H. A. Prout, and F. S. Cozzens.

Standing Committees were appointed as follows:

Publication—N. Holmes, Wm. M. McPheeters, and B. F. Shumard.

Library—H. A. Prout, C. A. Pope, and J. M. Krum.

Finance—J. M. Krum, Spencer Smith, and T. L. Rives.

Ethnology,	A. Wislizenus.
Comparative Anatomy,	C. A. Pope.
Mammalogy,	C. W. Stevens.
Embryology,	J. S. B. Alleyne.
Ornithology,	M. Lewis Clark.
Herpetology and Ichthyology,	M. M. Pallen.
Chemical Geology and Malacology,	H. A. Prout.
Entomology,	W. M. McPheeters.
Botany,	T. C. Hilgard.
Palæontology and Geology,	B. F. Shumard.
Mineralogy,	R. W. Bender.
Chemistry,	A. Litton.
Physics,	S. Smith.
Astronomy,	G. Seyffarth.
Meteorology,	A. Wislizenus.

January 25, 1858.

Vice Pres. Dr. A. WISLIZENUS in the chair.

Letters were read from Prof. Edward Suess, of the Imp. Museum of Mineralogy, Vienna, Aus.; from the Soc. of Arts, Manuf. and Commerce, London; from the Nat. Hist. Soc. of Northumberland, Durham, and Newcastle-upon-Tyne, Eng.; from the Geological Soc. of London; from the "Vereins für Natur-kunde zu Presburg, Hungary,"—severally acknowledging the receipt of the Transactions of the Academy.

Three skulls of the grizzly Bear were deposited in the Museum by Dr. C. W. Stevens; specimens of cupriferous iron pyrites from East Tennessee, and silicate of alumina from Alabama, were presented by Mr. Bender; silicious infusoria from Sweden, by Mr. F. S. Cozzens.

The Committee to whom was referred the paper by Mr. Smith on "An Hypothesis on the Formation of Hail," reported the same for publication.

February 8, 1858.

Dr. C. A. Pope in the chair.

Mr. R. W. Bender read a paper on the "Formation of Hail." Referred to a committee.

Prof. Edward Suess, of Vienna, Aus., G. C. Broadhead, of Columbia, Mo., E. Billings, Esq., of Montreal, Can., Major F. Hawn, of Weston, Mo., Rev. Dr. S. Y. McMasters, of Alton, Ills., and John James, M.D., of Upper Alton, were elected Corresponding Members; and Rev. Dr. Wm. G. Eliot, Rev. E. Carter Hutchinson, Rev. Montgomery Schuyler, and Mr. Oscar Collet, were elected Associates.

February 22, 1858.

Vice Pres. Dr. Wislizenus in the chair.

The Corresponding Secretary laid upon the table the Proceed. of the Bos. Soc. of Nat. Hist., Oct., 1857, to Jan., 1858, from the Soc.; and the Jour. of the Franklin Inst., No. 384, Vol. LXIV.

The following letter was read from Prof. G. C. Swallow:

Geological Rooms, Columbia, Mo., Feb. 18, 1858.

B. F. Shumard, *President of the St. Louis Academy of Science.*

My Dear Sir:—I have had the pleasure of examining a small collection of fossils from Kansas, made by Major F. Hawn, of the United States Survey of that Territory; and, as they show the development of a Geological system not known to exist in the West, it may interest your Academy to know the results.

I can have no doubt that the rocks are Permian, since the proof is very conclusive to my own mind, as it, doubtless, will be to yours. All of the described fossils, with perhaps two exceptions, are identical with Permian species of Russia and England, while all of the new species appear to be more nearly allied to Permian forms than to any other.

Three of the four species of Bryozoa are, without doubt, Permian.

1. *Thamniscus dubius* (King), is certainly in our collection.

2. *Fenestella retiformis* (King). Our specimens agree with the Russian species from the Permian, referred doubtfully to this by Lonsdale. (Geo. Russ., Vol. I., p. 630.)

3. *Thamniscus*, species not determined, but which seems to be identical with a Permian specimen figured in Geol. Trans., 2d Ser., Vol. 3, pl. 12, fig. 7.

4. *Schizodus Rossicus* (Verneuil), Geol. Russ., pl. 19, figs. 7 & 8. We have numerous specimens of this very important Permian fossil. Both varieties and the intervening forms are represented in our collection.

5. *Avicula antiqua*. (Geol. Russ., Vol. 2, pl. 20, fig. 13. Major Hawn's collection contains many specimens which appear to be identical with this Permian species.

Major Hawn's collection also contains specimens which are nearly, if not quite identical with *Productus horrescens*, *Ver.*, *Murchisonia subangulata*, *Ver.*, *Mytilus Pallasi*, *Solemya Biarmica*, *Ver.*, *Osteodesma Kutorgana*, *Ver.*, of the Permian in Russia, and *Cardinia Listeri* of the English Lias. There are also many specimens of *Monotis*, a genus seldom, if ever, found below the Permian.

I can but feel that these facts are sufficient to justify our decision that these rocks are *Permian*. Indeed, I know of no other formation in the West whose fossils would give so large a proportion of species identical with, and analogous to, those of the same rocks in any one locality in Europe, as these with the Permian of Russia.

It gives me great pleasure to announce through your Academy Major Hawn's important discovery, the result of his long and earnest labors to develop the Geology of Kansas. The friends of Western Geology will look forward with great interest to his forthcoming work on the results of his geological investigations in that Territory.

Very respectfully, your obed't serv't,
G. C. SWALLOW.

A paper by G. C. Swallow and F. Hawn, entitled "The Rocks of Kansas, with Descriptions of New Fossils from the Permian Formation in Kansas Territory," was read by the Corresponding Secretary, and referred to a committee consisting of Drs. Prout, Shumard and Wislizenus, and Mr. Smith.

Rev. C. F. Smarius, Rev. T. H. Newton, and Wm. S. Allen, Esq., were elected Associates.

March 8, 1858.

The President, Dr. B. F. SHUMARD, in the chair.

A letter was read from Dr. John James, elected a Correspondent.

The following works were placed upon the table: Explor. & Survs. of Pacif. R.R. Routes, Vol. IV., from Hon. L. M. Kennett; Iowa Hand-Book, by Ed. H. Parker, 1856, and the Kansas and Nebraska Hand-Book, 1857–8, by Edw. H. Parker, from the author; Proceed. of the Acad. Nat. Sciences, Philad., Dec., 1857, from the Society; Jour. of the Franklin Inst., No. 385, from the Society.

Dr. A. Wislizenus read a paper, entitled "Was Man contemporaneous with the Mastodon?" Referred to a committee.

The Corresponding Secretary read a continuation of the paper read at the last meeting, by G. C. Swallow and F. Hawn, on the "Rocks of Kansas," giving additional descriptions of New Species of Fossils from the Permian Formation in Kansas Ter. Referred to the same committee.

Dr. B. F. Shumard read a paper, entitled "Descriptions of New Fossils from the Coal Measures of Missouri and Kansas, by B. F. Shumard and G. C. Swallow."

On motion, this paper was referred to the Committee on Publication.

Dr. B. F. Shumard stated that since he had examined Maj. Hawn's Collection from the Permian Rocks of Kansas, he had studied a series of fossils from the White Limestone of the Guadalupe Mountains, New Mexico, which were obtained by his brother, Dr. G. G. Shumard, while acting in the capacity of Geologist of the Government Expedition under Capt. John Pope, for obtaining water by means of Artesian wells along the line of the 32d Parallel, and that he had arrived at the conclusion that these also were of Permian age. This White Limestone, he remarked, contains a number of fossils that are identical with Permian species of England and Russia, while others are near analogues of characteristic Permian forms of those countries; several are also identical with Permian species, described by Prof. Swallow, from Kansas. The Collection contains well marked examples of *Aulosteges*, a genus that has not been recognized in formations below the Permian; the species, however, is distinct from the English and Russian forms. There are specimens which agree perfectly with the descriptions and figures of *Camarophoria Schlotheimi*, *C. Geinitziana*, and *Productus Leplayi*, as given by Verneuil and King; also a *Productus* very analogous, if not identical, with *Productus Cancrini* and a *Terebratula*(?), which agrees with *T. superstes* of Verneuil in every respect, except that the dorsal valve of the American fossil is not quite so gibbous. There is also in the collection *Terebratula elongata*, *Terebratula* (*Spirigera*) *pectinifera*, *Spirifer cristata*, *Acanthocladia anceps*, *Synocladia*, and fragments of a *Monotis* which approaches nearest to *M. speluncaria*. Besides these, the collection embraces new species of *Productus*, *Spirifer*, *Chonetes*, *Corals*, *Trilobites*, and a slender *Fusulina* nearly two inches in length. Scarcely any of these fossils are positively identical with forms of our Western Coal Measures. According to the MS. Report of Dr. George G. Shumard, this

White limestone presents a thickness of more than a thousand feet.

Dr. Shumard further stated that he was preparing a paper on the new fossils from the Permian of the Guadalupe Mountains, which he hoped to complete in time to read before the next meeting of the Academy.

Messrs. Ernest Weyden and Frederick A. Churchill were elected Associates.

March 22, 1858.

The President, Dr. B. F. Shumard, in the chair.

A letter was read from the Horticultural Society, London, Eng., acknowledging the receipt of the Transactions of the Academy.

The following works were placed upon the table: Report of Explor. & Surv. of Pacific R.R. Routes, Vols. IV. & V., and the Rep. of the Superintendent of the U. S. Coast Surv., 1856, from the Hon. Frank P. Blair, Jr.; "A Geological Sketch of Canada, by W. E. Logan and T. Sterry Hunt," from Dr. Shumard; Jour. of the Franklin Inst., Vol. LXV., No. 387, from the Society.

The committee to whom was referred the paper of Dr. Wislizenus, "Was Man contemporary with the Mastodon?" recommended the same for publication. The paper of Mr. Bender on the "Formation of Hail" was referred to the Committee on Publication.

The committee to whom was referred the paper of G. C. Swallow and F. Hawn, entitled "The Rocks of Kansas, with Descriptions of New Permian Fossils," recommended the same for publication.

A paper, entitled "On the Ultimate Analysis of Light, by John James, M.D.," was read by the Corresponding Secretary, and referred to a committee.

Dr. H. A. Prout read a paper, entitled "Descriptions of New Species of Bryozoa from Texas and New Mexico, collected by Dr. George G. Shumard, Geologist of the U. S. Expedition for Boring Artesian Wells along the 32d Parallel, under the direction of Capt. John Pope, U. S. Corps Top. Eng." Referred to a committee.

Dr. B. F. Shumard read a paper, entitled "Descriptions of New Fossils from the Permian Rocks of the Guadalupe Mountains, in New Mexico, collected by Dr. George G. Shumard, Geologist of the Expedition for obtaining Water, by means of Artesian Wells, along the line of the 32d Parallel, under the direction of Capt. John Pope, U. S. Corps Top. Eng." The paper was referred to a committee.

Rev. Alexander Proctor, Rev. E. F. Berkeley, and Messrs. Thomas E. Day, Edward F. Pittman, and Edw'd Miller, were elected Associate Members.

April 5, 1858.

President, Dr. B. F. Shumard, in the chair.

The following works were received from the Hon. Frank P. Blair, Jr.: Report of Explor. & Surveys of Pacific Railroad Routes, Vol. VI.; Report of Sup't of U. S. Coast Surv., 1855; Finance Report, 1854; Compend. of U. S. Census, 1850; and Report of U. States & Mexican Boundary Survey, by W. H. Emory, Vol. I.

A paper was read by Prof. Seyffarth, D.D., entitled "A Remarkable Seal, in Dr. Abbott's Egyptian Museum at N. York, Explained;" which, on motion, was referred to the Committee on Publication.

The following letter was read from Dr. J. G. Norwood:

Springfield, Ills., March 31, 1858.

To B. F. Shumard, M.D.,
President of the Academy of Science of St. Louis.

Dear Sir:—I beg leave to submit for the consideration of the Academy the following remarks on some of the rocks of Illinois, which overlie the main Coal Measures in several counties of this State.

In 1855–6, while making examinations in the La Salle Coal-field, I found in the upper beds a number of organic remains which were entirely new to me, but belonging mostly to genera liberally distributed through the Coal Measures of this and the neighboring States. Being associated with Coal Measure fossils and intimately connected with beds of coal, they were considered to belong to the true Carboniferous era. In the winter of 1856, I caused drawings to be made of some of them, with the intention of describing them in connection with the late Mr. Henry Pratten. Since his death these drawings have not been found. Last summer Mr. H. A. Ulffers wrote out descriptive notes of several new *Producti* and *Chonetes* from the localities alluded to, to be used in a small monograph on *Producti* and *Chonetes* which I was then having printed, but which still remains unfinished.

My attention was not especially directed to a comparison of these fossils with organic remains peculiar to rocks of the Permian system, as established by Sir Roderick Murchison and other European geologists, until since the announcement, made by Prof. Swallow, of Missouri, of the existence of Permian rocks in the Territory of Kansas, which was soon followed by the publication of the same fact by Mr. F. B. Meek and Dr. F. V. Hayden. Having thus had my attention directed to this subject, after a review of some of the fossils found in Bureau, La Salle, and Henry Counties, I have become satisfied that the upper beds at least of the La Salle rocks are of the same age as those containing many of the organic remains described by the gentlemen above named as belonging to the Permian rocks of Kansas.

Among the fossils are *Pecten Cleavelandicus* (*Swallow*), *Mytilus squamosus* (*Sow.*), *Productus Norwoodii* (*Swal.*), *Monotis radialis?* (*Phil.*), *Edmondia*

Murchisonia? (*King*), *Leda* (*Nucula*) *subscitula* (*Meek & Hayden*). In a paper which I am preparing for the Academy, the whole fauna of these rocks will be noticed so far as I am acquainted with it, and a comparison instituted between that and the underlying Coal Measures. In the meantime, I enclose a vertical section of the rocks at one point in La Salle County.

The beds are composed of sandstones and conglomerates, magnesian limestone, slates, and red and blue gypseous marls, all of them resting uncomformably on the underlying beds. In addition to the beds named, three thin seams of coal occur in the rocks alluded to as seen in the section: thus showing, that, if this formation shall be proved to belong, undoubtedly, to the Permian period, the great probability is, that the upper beds of coal in several sections of the State are of the same age. This is rendered almost certain from the very partial examination I have been able to make of the organic remains from other localities. I may also mention the occurrence in the slates of scales of a *Platysomus*, which belongs to the Permian epoch.

SECTION OF THE ROCKS AT LA SALLE—DESCENDING.

No.		*ft.*	*in.*
1.	Bluish and reddish clay shales	14	8
2.	Limestone (brecciated)	15	8
3.	Gray shale, irregular	4 to 6	
4.	Gray compact limestone, fossiliferous	14	9
5.	Black slate, irregular		6
6.	Shaly limestone, very irregular in thickness		8
7.	Coal	1	
8.	Limestone	26	8
9.	Shale, gray	1	
10.	Gray limestone	7	
11.	Gray shale	5	
12.	Blue limestone	5	
13.	Black slate	7	
14.	Coal		5
15.	Blue shale	9	5
16.	Limestone	1	6
17.	Coal		1
18.	Fire clay		3
19.	Shale	9	3
20.	Limestone	3	5
21.	Coal		1
22.	Fire clay		3
23.	Blue shale	17	1
24.	Gray limestone	3	5
25.	Blue shale	9	5
26.	Gray limestone	2	5
27.	Blue shale	12	
28.	Blue limestone	2	
29.	Blue shale	1	
30.	Black slate	2	5
31.	Blue shale	13	
32.	Hard limestone	4	
33.	Blue shale	2	7
34.	Blue limestone		5
35.	Red shale	2	
36.	Limestone		3
37.	Red shale	4	5
38.	Brown shale	10	
39.	Sandstone	18	
40.	Silicious shale	19	
41.	Slaty shale	11	3
42.	Black slate	6	
43.	Coal	4	5

This section embraces only a portion of the rocks of La Salle, while in Bureau County, beds occur which overlie all those here given.

I will forward to the Academy, as soon as completed, a notice of the Geology of that region, together with that of such other sections of the State as appear from a comparison of their fossils to be of the same age.

Very respectfully,

J. G. NORWOOD.

Dr. Koch stated, in relation to the bones of Mastodon discovered by him in Gasconade Co., in 1839, and referred to by Dr. Wislizenus in the paper read by him, at a late meeting of the Academy, that, at the time when he made the discovery alluded to, he had been fully aware of its importance, and, accordingly, had taken care to preserve all the bones, (of which fact Dr. W. seemed not to be aware,) as well those which were partially burned as those which were unburnt; all the weapons and other objects mentioned in his published paper, consisting of two stone axes, several stone spears, and arrow-heads, all bearing evidence of the action of fire; and, also, portions of the wood cinders, charcoal, and ashes, samples of the clay in which the animal had been mired, and of the black alluvium by which the bones had been covered afterwards,—and that they were now in the Royal Museum of the University of Berlin, where any person might examine them. They had been exhibited, soon after their discovery and exhumation, in St. Louis, in Philadelphia, and in London, where they had attracted the attention of the late Drs. Harlan and Morton, Sir Charles Lyell, and other distinguished scientific gentlemen.

Concerning the arrow-head lying underneath the femur of the Mastodon, in Benton Co. Mo., he would further state, that the place where the arrow-head had come in contact with the bone could still be discriminated by its greater whiteness, the remainder of the bone's surface being of a brownish color. Dr. K. exhibited a profile section of the deposits cut through in the excavation at this locality. He observed further, that, so far as he knew, only five skeletons of *M. giganteus* had thus far been discovered, the bones of which had not been so far separated and scattered as to preclude their being brought together again and arranged so as to form a complete articulated skeleton. Of these five, one had been formerly exhibited in Peale's Museum, in Philadelphia; there was one in Baltimore; one on the continent of Europe; the skeleton found in Benton Co., Mo. (now in London); and, lastly, that of the late Dr. John C. Warren, in Boston, Mass.

Mr. Holmes remarked, touching this subject, that he did not agree with Dr. Wislizenus that it could be considered "a hasty and thus far unwarranted supposition that Man had existed contemporaneously with the Mastodon." Nor could the *M. giganteus* be considered as an ante-diluvial rather than a post-diluvial animal. Properly speaking, there had been no such geological era as a diluvial period. Diluvium or marine drift and alluvium or fresh-water drift had been common to all geological periods since there had been land above water. This subject had been amply illustrated by Prof. Hitchcock. (Surface Geol.) Prof. R. Owen, of London, had expressed the opinion (Brit. Fos. Mam.) that it was negative evidence only that excluded Man from the Pliocene fauna of the British Isles. Pictet had considered the question to be: What animals inhabited Europe when Man first appeared there, and thence, at what geological epoch his origin was to be placed? And this learned author (Trait. de Palé., Vol. I.), admitting with other Palæontologists, that there were, as yet, no positive proofs of the existence of Man, in Europe, during the Older Pliocene, nor as early as the great northern boulder drift of the Newer Pliocene, had nevertheless concluded, that Man had established himself in that country but a short time after that drift, the continent not having been wholly submerged; that these first inhabitants saw the cavern bears, elephant, rhinoceros, and other animals of the Older Pliocene age, which became extinct in Europe in the Newer Pliocene; and that some of them were victims of the same inundations which had filled the caverns with the bones of these animals, human bones having been found mingled together with them in the same deposits and caves, rolled and water-worn in like manner, and in the same altered condition of their texture. And this would seem to be conclusive of their contemporaneousness. In America, the Rhinoceros had not been found in deposits later than the Miocene, nor the *M. giganteus* in deposits earlier than the Post-Pliocene; and this age was later than the cavern epoch. Prof. F. S. Holmes, of Charleston, S. C., had lately established that not only the tapir, peccary, raccoon, opossum, deer, elk, and musk-rat, of species still living, but some domestic animals, also, as the horse, sheep, hog, and ox, which (so far as positive evidence went) became extinct before the arrival of the white race in America, were contemporaries with the Mastodon, Megatherium, and Megalonyx, on this continent, in the time of the Post-Pliocene deposits of South Carolina; and in this conclusion he had the concurrence of Agassiz. It was very certain that neither the entire surface drained by the Mississippi, nor the whole southern portion of the United States, had been submerged under the ocean, since the Post-Pliocene era, so as to cut off the stream and succession of mammalian life.

Professor Holmes had further expressed the opinion, that although "it has been acknowledged that the mastodon, megatherium, elephant, glyptodon, and two species of Equine genera, etc., are entirely extinct, yet the discoveries made of the remains of even some of these would indicate that they still existed at a period so recent, that, in the language of Prof. Leidy, "it is probable the red man witnessed their declining existence."—(Post-Pliocene Foss., 1858.) It was not the purpose of Mr. H. to allude to the proofs, that existed, of the contemporaneousness of Man and the Mastodon on this continent, but merely to observe, that the researches of eminent Geologists seemed, thus far, to have furnished no scientific ground of objection by way of antecedent improbability against the hypothesis.

Mr. Harrison presented a fossilized nut, from Hanging-Rock District, Ohio; also, a mass of iron ore, from the Iron Mountain, Mo., about ten feet beneath the surface, in ferruginous clay, at the foot of the mountain.

Rev. D. B. Woods, and John Lapsley, Esq., were elected Associates.

April 12, 1858.

The President, Dr. B. F. Shumard, in the chair.

The following works were received: "On the Egg-Tooth of Snakes and Lizards, by Dr. David F. Weinland," presented by Mr. Harrison; "Proceedings of the Dedication of Plummer Hall, Salem, Oct., 1857," from the authors; "Vital Statistics, by Dr. Wynne," presented by Dr. McPheeters; "Map of Territory of U. S. from the Mississippi to the Pacific Ocean, etc., by Lieut. G. K. Warren," from the author.

A paper from Prof. G. C. Swallow, on "Grape Culture in Missouri," was read by the Corresponding Secretary, and referred to a committee.

A letter was read from Major F. Hawn, communicating a paper "On the Trias of Kansas"; which was read, and referred to a committee.

April 19, 1858.

The President, Dr. B. F. Shumard, in the chair.

A letter was read, dated March 15, 1858, from the "Société Imp. des Naturalistes de Moscou," acknowledging the receipt of the Trans. of the Academy, and advising them that the "Bulletins" of the Imperial Society would be sent in return through the agency of the Smithsonian Inst'n; also, a letter, dated Jan. 17, 1858, from the "Académie des Sciences, Arts et Belles-Lettres de Dijon," acknowledging the receipt of the Trans. of the Academy, and advising them of the transmission of the "Mémoires" of the Academy of Dijon, 2d Ser., Vols. I.—V., through the agency of the Smith'n Inst'n; also, a letter, dated Jan. 9th, 1858, from the "Imp. Regio Istituto Lombardo di Scienze, Lettere ed Arti," of Milan, acknowledging the receipt of the Trans., and advising the Academy that the publications of the Imperial Institute would be sent in return through the agency of the Smith'n Inst'n.

The following works were laid upon the table: "Mémoires de l'Académie des Sciences, Arts et Belles-Lettres de Dijon," 2d Ser., Vols. I., II., III., IV. & V., 1851-56, from the Academy; "Description d'un Nouveau Genre d'Édenté Fossile—Atlas—par L. Nodot," from the Author; "Lettres sur les Roches du Jura et leur Distribution Géographique dans les Deux Hémisphères, par Jules Marcou," Paris, 1857,—"Cours de Géologie Paléontologique," Zurich, 1856,—"Esquisse d'une Classification des Chaines de Montagnes d'une partie de l'Amérique du Nord, par M. Jules Marcou," Paris, 1855,—"Carte Géologique des États-Unis et des Provinces Anglaises de l'Amérique du Nord, par Jules Marcou," 1855,—"Institut de France—Acad. des Sciences: Rapport sur un Mémoire de M. Jules Marcou, relatif à la Class'n des Chaines de Montagnes d'une partie de l'Amérique du Nord,"—from Prof. Jules Marcou; "Crustacea and Echinodermata of the Northern Pacific Shores, by Wm. Stimpson," Camb., 1858, from the Author; "Eighth Ann. Rep. of the Board of Directors of the Pacific R.R.," and "Address by E. Miller, Chief Eng.," from E. Miller.

An Indian quoit was presented by E. Miller, and a black snake, by E. Weyden.

The Special Committee to whom was referred the paper entitled "On the Ultimate Analysis of Light" made their report, and were discharged.

The Committee to whom was referred the paper entitled "Grape Culture in Missouri" reported the same for publication in the Transactions.

The Committee to whom was referred the paper by Major F. Hawn, on "The *Trias* of Kansas," reported the same for publication.

O. G. Cates, Esq., was elected an Associate Member.

conclusive to my own mind, as it, doubtless, will be to yours. All of the described fossils, with perhaps two exceptions, are identical with Permian species of Russia and England, while all of the new species appear to be more nearly allied to Permian forms than to any other.

Three of the four species of Bryozoa are, without doubt, Permian.

1. *Thamniscus dubius* (King), is certainly in our collection.

2. *Fenestella retiformis* (King). Our specimens agree with the Russian species from the Permian, referred doubtfully to this by Lonsdale. (Geo. Russ., Vol. I., p. 630.)

3. *Thamniscus*, species not determined, but which seems to be identical with a Permian specimen figured in Geol. Trans., 2d Ser., Vol. 3, pl. 12, fig. 7.

4. *Schizodus Rossicus* (Verneuil), Geol. Russ., pl. 19, figs. 7 & 8. We have numerous specimens of this very important Permian fossil. Both varieties and the intervening forms are represented in our collection.

5. *Avicula antiqua*. (Geol. Russ., Vol. 2, pl. 20, fig. 13. Major Hawn's collection contains many specimens which appear to be identical with this Permian species.

Major Hawn's collection also contains specimens which are nearly, if not quite identical with *Productus horrescens*, *Ver.*, *Murchisonia subangulata*, *Ver.*, *Mytilus Pallasi*, *Solemya Biarmica*, *Ver.*, *Osteodesma Kutorgana*, *Ver.*, of the Permian in Russia, and *Cardinia Listeri* of the English Lias. There are also many specimens of *Monotis*, a genus seldom, if ever, found below the Permian.

I can but feel that these facts are sufficient to justify our decision that these rocks are *Permian*. Indeed, I know of no other formation in the West whose fossils would give so large a proportion of species identical with, and analogous to, those of the same rocks in any one locality in Europe, as these with the Permian of Russia.

It gives me great pleasure to announce through your Academy Major Hawn's important discovery, the result of his long and earnest labors to develop the Geology of Kansas. The friends of Western Geology will look forward with great interest to his forthcoming work on the results of his geological investigations in that Territory.

Very respectfully, your obed't serv't,

G. C. SWALLOW.

A paper by G. C. Swallow and F. Hawn, entitled "The Rocks of Kansas, with Descriptions of New Fossils from the Permian Formation in Kansas Territory," was read by the Corresponding Secretary, and referred to a committee consisting of Drs. Prout, Shumard and Wislizenus, and Mr. Smith.

Rev. C. F. Smarius, Rev. T. H. Newton, and Wm. S. Allen, Esq., were elected Associates.

March 8, 1858.

The President, Dr. B. F. Shumard, in the chair.

A letter was read from Dr. John James, elected a Correspondent.

The following works were placed upon the table: Explor. & Survs. of Pacif. R.R. Routes, Vol. IV., from Hon. L. M. Kennett; Iowa Hand-Book, by Ed. H. Parker, 1856, and the Kansas and Nebraska Hand-Book, 1857–8, by Edw. H. Parker, from the author; Proceed. of the Acad. Nat. Sciences, Philad., Dec., 1857, from the Society; Jour. of the Franklin Inst., No. 385, from the Society.

Dr. A. Wislizenus read a paper, entitled "Was Man contemporaneous with the Mastodon?" Referred to a committee.

The Corresponding Secretary read a continuation of the paper read at the last meeting, by G. C. Swallow and F. Hawn, on the "Rocks of Kansas," giving additional descriptions of New Species of Fossils from the Permian Formation in Kansas Ter. Referred to the same committee.

Dr. B. F. Shumard read a paper, entitled "Descriptions of New Fossils from the Coal Measures of Missouri and Kansas, by B. F. Shumard and G. C. Swallow."

On motion, this paper was referred to the Committee on Publication.

Dr. B. F. Shumard stated that since he had examined Maj. Hawn's Collection from the Permian Rocks of Kansas, he had studied a series of fossils from the White Limestone of the Guadalupe Mountains, New Mexico, which were obtained by his brother, Dr. G. G. Shumard, while acting in the capacity of Geologist of the Government Expedition under Capt. John Pope, for obtaining water by means of Artesian wells along the line of the 32d Parallel, and that he had arrived at the conclusion that these also were of Permian age. This White Limestone, he remarked, contains a number of fossils that are identical with Permian species of England and Russia, while others are near analogues of characteristic Permian forms of those countries; several are also identical with Permian species, described by Prof. Swallow, from Kansas. The Collection contains well marked examples of *Aulosteges*, a genus that has not been recognized in formations below the Permian; the species, however, is distinct from the English and Russian forms. There are specimens which agree perfectly with the descriptions and figures of *Camarophoria Schlotheimi*, *C. Geinitziana*, and *Productus Leplayi*, as given by Verneuil and King; also a *Productus* very analogous, if not identical, with *Productus Cancrini* and a *Terebratula*(?), which agrees with *T. superstes* of Verneuil in every respect, except that the dorsal valve of the American fossil is not quite so gibbous. There is also in the collection *Terebratula elongata*, *Terebratula* (*Spirigera*) *pectinifera*, *Spirifer cristata*, *Acanthocladia anceps*, *Synocladia*, and fragments of a *Monotis* which approaches nearest to *M. speluncaria*. Besides these, the collection embraces new species of *Productus*, *Spirifer*, *Chonetes*, *Corals*, *Trilobites*, and a slender *Fusulina* nearly two inches in length. Scarcely any of these fossils are positively identical with forms of our Western Coal Measures. According to the MS. Report of Dr. George G. Shumard, this

White limestone presents a thickness of more than a thousand feet.

Dr. Shumard further stated that he was preparing a paper on the new fossils from the Permian of the Guadalupe Mountains, which he hoped to complete in time to read before the next meeting of the Academy.

Messrs. Ernest Weyden and Frederick A. Churchill were elected Associates.

March 22, 1858.

The President, Dr. B. F. SHUMARD, in the chair.

A letter was read from the Horticultural Society, London, Eng., acknowledging the receipt of the Transactions of the Academy.

The following works were placed upon the table: Report of Explor. & Surv. of Pacific R.R. Routes, Vols. IV. & V., and the Rep. of the Superintendent of the U. S. Coast Surv., 1856, from the Hon. Frank P. Blair, Jr.; "A Geological Sketch of Canada, by W. E. Logan and T. Sterry Hunt," from Dr. Shumard; Jour. of the Franklin Inst., Vol. LXV., No. 387, from the Society.

The committee to whom was referred the paper of Dr. Wislizenus, "Was Man contemporary with the Mastodon?" recommended the same for publication. The paper of Mr. Bender on the "Formation of Hail" was referred to the Committee on Publication.

The committee to whom was referred the paper of G. C. Swallow and F. Hawn, entitled "The Rocks of Kansas, with Descriptions of New Permian Fossils," recommended the same for publication.

A paper, entitled "On the Ultimate Analysis of Light, by John James, M.D.," was read by the Corresponding Secretary, and referred to a committee.

Dr. H. A. Prout read a paper, entitled "Descriptions of New Species of Bryozoa from Texas and New Mexico, collected by Dr. George G. Shumard, Geologist of the U. S. Expedition for Boring Artesian Wells along the 32d Parallel, under the direction of Capt. John Pope, U. S. Corps Top. Eng." Referred to a committee.

Dr. B. F. Shumard read a paper, entitled "Descriptions of New Fossils from the Permian Rocks of the Guadalupe Mountains, in New Mexico, collected by Dr. George G. Shumard, Geologist of the Expedition for obtaining Water, by means of Artesian Wells, along the line of the 32d Parallel, under the direction of Capt. John Pope, U. S. Corps Top. Eng." The paper was referred to a committee.

Rev. Alexander Proctor, Rev. E. F. Berkeley, and Messrs. Thomas E. Day, Edward F. Pittman, and Edw'd Miller, were elected Associate Members.

April 5, 1858.

President, Dr. B. F. Shumard, in the chair.

The following works were received from the Hon. Frank P. Blair, Jr.: Report of Explor. & Surveys of Pacific Railroad Routes, Vol. VI.; Report of Sup't of U. S. Coast Surv., 1855; Finance Report, 1854; Compend. of U. S. Census, 1850; and Report of U. States & Mexican Boundary Survey, by W. H. Emory, Vol. I.

A paper was read by Prof. Seyffarth, D.D., entitled "A Remarkable Seal, in Dr. Abbott's Egyptian Museum at N. York, Explained;" which, on motion, was referred to the Committee on Publication.

The following letter was read from Dr. J. G. Norwood:

Springfield, Ills., March 31, 1858.

To B. F. Shumard, M.D.,
President of the Academy of Science of St. Louis.

Dear Sir:—I beg leave to submit for the consideration of the Academy the following remarks on some of the rocks of Illinois, which overlie the main Coal Measures in several counties of this State.

In 1855–6, while making examinations in the La Salle Coal-field, I found in the upper beds a number of organic remains which were entirely new to me, but belonging mostly to genera liberally distributed through the Coal Measures of this and the neighboring States. Being associated with Coal Measure fossils and intimately connected with beds of coal, they were considered to belong to the true Carboniferous era. In the winter of 1856, I caused drawings to be made of some of them, with the intention of describing them in connection with the late Mr. Henry Pratten. Since his death these drawings have not been found. Last summer Mr. H. A. Ulffers wrote out descriptive notes of several new *Producti* and *Chonetes* from the localities alluded to, to be used in a small monograph on *Producti* and *Chonetes* which I was then having printed, but which still remains unfinished.

My attention was not especially directed to a comparison of these fossils with organic remains peculiar to rocks of the Permian system, as established by Sir Roderick Murchison and other European geologists, until since the announcement, made by Prof. Swallow, of Missouri, of the existence of Permian rocks in the Territory of Kansas, which was soon followed by the publication of the same fact by Mr. F. B. Meek and Dr. F. V. Hayden. Having thus had my attention directed to this subject, after a review of some of the fossils found in Bureau, La Salle, and Henry Counties, I have become satisfied that the upper beds at least of the La Salle rocks are of the same age as those containing many of the organic remains described by the gentlemen above named as belonging to the Permian rocks of Kansas.

Among the fossils are *Pecten Cleavelandicus (Swallow)*, *Mytilus squamosus (Sow.)*, *Productus Norwoodii (Swal.)*, *Monotis radialis? (Phil.)*, *Edmondia* it does not rise so abruptly from the general surface. This latter variety of our shell resembles somewhat *Inoceramus convexus* (Hall & Meek), from which it is easily distinguished by the concentric lines of the surface, which are much wider apart. The *I. Vancouverensis* is also much less oblique, and this character also separates it from *I. Sagensis* (Owen), to which it bears some resemblance.

Dimensions.—The measurements of the best specimen in the collection are—length, 4 inches; height, 4 inches; thickness of left valve, $\frac{3}{8}$ inch. There are, however, some fragments which show that this species attains a much greater size, perhaps more than double the dimensions here given.

Form. & Loc.—Occurs in the dark argillaceous, compact limestone of Nanaimo River, Vancouver's Island. Dr. Evans placed fragments of this shell in my hands for investigation several years since, from the same locality, along with a *Nautilus* which appears to be identical with *N. Dekayi* (Morton) and other forms of the Cretaceous system. But, notwithstanding their great interest, as pointing out for the first time the existence of Cretaceous rocks in that region, these fossils were not described, as they were not sufficiently well preserved to permit an accurate determination of their specific characters. Subsequently Dr. Evans again visited this locality and obtained a number of more perfect specimens, and among the others a fine collection of *I. Vancouverensis.*

PINNA CALAMITOIDES, *Shumard.*

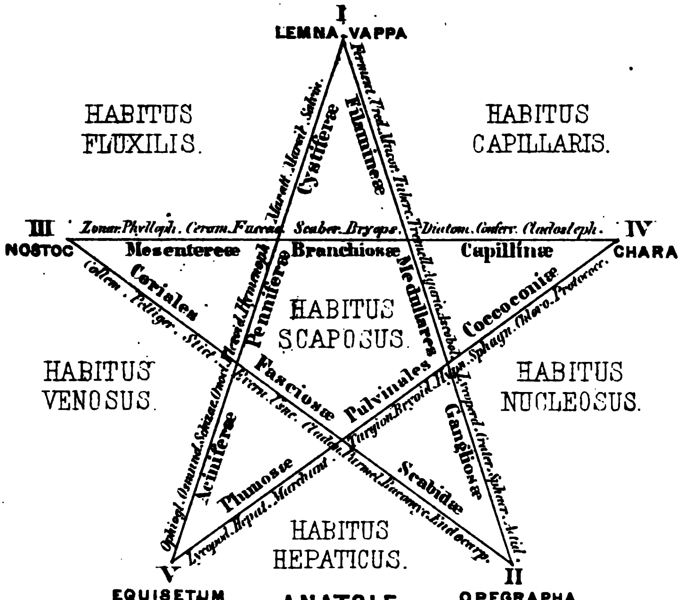
Shell elongated, triangular, compressed, slightly curved, umbones rounded; buccal portion attenuated; ligament margin acute, arcuate; palleal margin gently concave; surface marked with about fourteen slender, rounded, longitudinal ribs, separated by spaces much wider than the ribs. On the ligament side of the shell these ribs are quite distinct, regular and nearly equidistant, but on the palleal portion they are partially effaced, and assume the form of irregular and rather broad folds.

Dimensions.—Apicial angle, 28°; at the distance of about two inches from the point of the beak the width is 13 lines, and the thickness 6 lines.

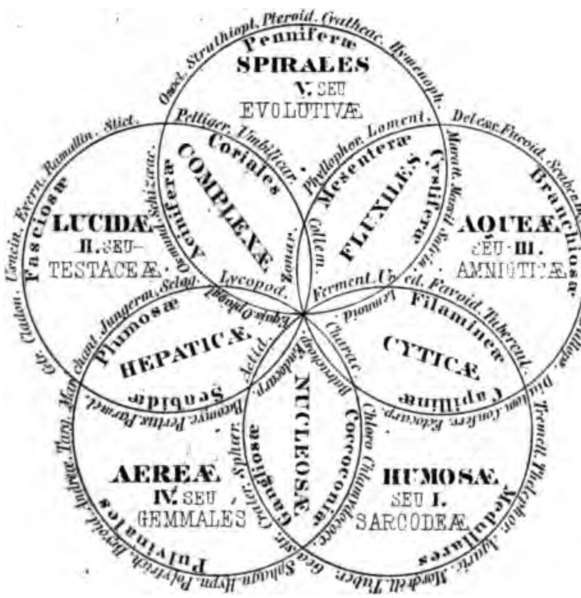
A single specimen, only, of this shell has come under my observation. It is somewhat mutilated, the extremities being broken off and the surface more or less exfoliated. An examination of more perfect individuals may therefore render it necessary to slightly modify the above description.

For. & Loc.—Cretaceous formation of Nanaimo River, Vancouver's Island. The fragment of rock in which the specimen was embedded is a dark greenish argillaceous, sandy-textured limestone, with dark igneous pebbles disseminated through it.

ASTROCYCLUS OF SPOROPHYTA,
ELEMENTARIÆ seu SEMINALES.



ANATOLE.



SYNARMOSIS.

L. Gast & Brother St. Louis.


HABITUS
LIRIODENDREUS
s. polymerus
Ranunculaceae
Berberideae
Anonaceae
Magnoliaceae
Schizandraceae
Menispermum
Gyrocarpeae
Laurineae
Monimiaceae
Calycantheae
Eupomatia
Serpentariae
Papaverac.
Cucurbit.
Gronov.
Passiflor.
Homalin.
Samyd.
Bixac.
Byttner.
Tiliae.
Stercul.
Malvac.
Phytolacc.
Coriar.
Tremandr.
Erythroxyl.
Olacac.
Ternstroem.
Clusiac.
Dipterocarp.
III
IV
II
HABITUS
PEPONEUS
COLUMNIFERÆ
VIOLARIÆ
SAMARATÆ
Nepenthes
Sarraceniae
Droseraceae
Parnassia
Violaceae
Araliaceae
Umbelliferae
Rhizophoreae
Trapa
Rhizoboleae
Kramerieae
Polygaleae
Melianthear
Aesculinae
Sapindaceae
Malpighiaceae
Acerinae
Fraxineae
Ulmaceae
Betulinae
Quercinae
Myricinae
Juglandeae
Datisca
HABITUS
SAPINDEUS
s. nectarinus
HABITUS
CARYODES
ENTOIDEÆ
Haloragaeae
Saxifrageae
Crassae
NYCTAGINES
s. scariosae
SILIQUOSÆ
Vochysiaceae?
Tropaeolaceae
Geraniaceae
Oxalideae
Balsamineae
Fumariaceae
Papaveraceae
Cruciferae
Capparideae
Cistinae
Turneraceae
Loasaceae
DIANTHOIDEÆ
Alsineae
Diantheae
Sclerantheae
Frankeniaceae
Nyctagineae
Statice
Armeria
Lineae
Hypericinae
II
ASTRUM.
A. M. Weiss
Gratae memoriae dedicavit
T. C. Hilgard, M.D.

Descriptions of New Fossils *from the Tertiary Formation of Oregon and Washington Territories and the Cretaceous of Vancouver's Island, collected by Dr. Jno. Evans, U. S. Geologist, under instructions from the Department of the Interior.*

BY B. F. SHUMARD, M.D.

TERTIARY SPECIES.

Lucina fibrosa, *Shumard.*

Shell compressed, convex, inequilateral, length greater than the height; buccal margin obtusely subangulate above, obliquely subtruncate below; basal margin very slightly arched, or straight in the middle and rounded at the extremities; anal margin rounded; ligament margin straight in young specimens and gently arched in the adult; ligament impression lanceolate, deeply excavated, wrinkled, margined by a slightly elevated carina; beaks obtusely rounded, slightly elevated; surface with inequidistant concentric lines of growth, and a broad transverse fold in advance of the beaks. With a magnifier we can perceive close, fibrous, longitudinal striæ in the spaces between the concentric lines; these are quite irregular and frequently bifurcate. In old age the shell assumes a subquadrate form, and the basal margin is quite straight or even slightly concave.

Length, about 26 lines; height, 20 lines; thickness, 9 lines. There are fragments in the collection which show that this species considerably exceeds these proportions.

Form. & Loc.—Obtained by Dr. Evans in dark argillaceous shale at Port Orford, Oregon Territory, and at Davis' Coal Mine. The specimens under observation are crushed and distorted from pressure.

Corbula Evansana, *Shumard.*

Shell subtrigonal, gibbous, slightly inequivalve, inequilateral, length greater than the height; buccal margin short, rounded; anal end oblique, prolonged, somewhat rostrate, obliquely truncated at the extremity; posterior slope forming nearly a right angle with the umbo. An elevated sharp carina extends from the beak of each valve to the posterior inferior extremity, and interior to this is a second carina, which is somewhat rounded and usually most distinct in the right valve; basal margin obtusely rounded, slightly produced near the middle, and in most specimens slightly contracted posteriorly; beaks flattened near the anterior margin, convex, rather prominent, incurved; surface marked with fine, rather indistinct, concentric striæ, and generally with several distinct folds. The cardinal tooth of the right valve is thick, trigonal, and placed under the beak nearest the buccal side, while the cavity for receiving the tooth of the opposite valve is triangular, deep, and situated directly under the beak. The substance of the shell is rather thick, and at the cardinal margin quite robust.

Length, 7½ lines; height, about 5 lines; thickness, 4½ lines. These proportions vary somewhat with the age of the shell.

Although the collection contains many specimens, not one of them retains its original form, all being more or less distorted from pressure.

In a few specimens the posterior slope exhibits a double carina on only one of the valves and a single exterior one on the other, but generally there are two carinæ on each valve.

Our shell resembles *C. densata* (Conrad), from which it is distinguished by the double carina on the posterior side and its thinner valves.

Form. & Loc.—This species is exceedingly abundant in the dark aluminous shale at Davis' Coal Mine, and at the Coal Mines of Port Orford, where it is associated with *Lucina fibrosa*, and *Cerithium Klamethensis.*

LEDA WILLAMETTENSIS, *Shumard.*

Shell small, oblong-ovate, convex, inequilateral; buccal margin gently arched, and forming with the cardinal margin nearly a right angle; anal side prolonged, rostrated, truncated at the extremity; basal margin slightly arched; cardinal border oblique in advance of the beak and slightly excavated behind; beaks sub-medial not very prominent. The surface markings are entirely obliterated on the only specimen we have obtained of this species.

Form. & Loc.—Occurs with *Lucina parilis* in dark-gray silicious limestone, at Brooks' Lime Quarry, Willamette Valley, five miles north of Salem, Oregon Territory.

LEDA OREGONA, *Shumard.*

Compare *Leda* (*Nucula*) *impressa* (Conrad), in Geol. of U. S. Exploring Expedition.

Shell rather large, ovate, compressed, convex; anterior extremity strongly arched; posterior extremity rostrate, slightly recurved, truncated; basal margin forming a broad curve, slightly contracted near the posterior extremity; ligament margin slightly concave; beaks situated a little in advance of the middle; surface neatly ornamented with regular, concentric, impressed lines, becoming more approximate above;

dition of the object *on its own determinative factors;* for, the consideration most consistently characterizing the concrete objects and under their most varied bearings is that which qualifies all the ultimate effects through their causative conditions; and, being the most catholically applicable, when once conceived, is most apt to be assumed into the universal application of thought, and thence of language. Classification of the ultimates from their fundamental relations is "*understanding*," "intellection," or, appreciation of the special by the general.

All understanding takes place by syllogistic derivation of the known ultimates from their granted fundamentals, or efficient categories. Hence, without the fundamental ideas, no syllogistic comprehension or understanding is possible.

In experimental, analytic, or "inductive" science, where we are bound to proceed on the granted ultimate phenomena, such as conceived, the fundamental or explanatory ideas being themselves the occult object in question, they remain to be *introduced*, in order to effect an understanding.

Therefore, the progressive introduction of the explanatory ideas is the vital vein of progress in analytic science.

Science itself being, like intelligence generally, (A. M. Weiss) perceptive, knowing, and creative, its conceptions are correspondingly diagnostic, dogmatic, and indagative. The first class is embodied by the diagnostic hand-books, the second by the "text-books," or dogmatic representations of the conceived truths, the third by the *progressively suggestive* "questions to reality" (Humboldt), their synthetic application and logical test, or the creative operations of the mind.

Science itself is the systematic survey and nexual understanding of phenomena, whether that *nexus* be a truly causal one, or merely one of typical associations, called "laws." From the knowledge of nexual relations, we are enabled to "class," or, collectively appreciate, the multitudinous ultimate phenomena under the simplified points of view of their efficient factors, involving and catholically elucidating them in all their combinations, permutations and possible ultimate consequences, as from a focus of light, or any luminous point, which actually unites and exercises the several qualities, especial energies, and directions of the infinite number of rays therein involved.

The deeper we penetrate into the conception of the truly efficient and fundamental relations, i. e., true laws and true causes, the ampler in compass and profounder in causal graduation become the phenomenal domains (Proc. Am. Ass'n, p. 255) thereby qualified into their most ultimate effects (Prof. B. Peirce's Lect. Potential Physics, Smith. Inst.), which constitute the prompted *subject* of science, whilst the pervasive understanding thereof *is* science itself.

The required conception of a fundamental relation, once advanced, the test of its competency is, whether all the consequences thence derivable, consistently with the fundamental position offered, do coincide with the respective real phenomena. Hence its sufficiency can, at most, be proved only in those cases upon which it is brought to bear, and upon which it may be borne out, as by so many odds in favor of its truth, or upon which it can, by any actual discrepancy between it and the respective real effects, be thus far disproved.

The mind of animals, as numerous observations on animal sagacity render probable, is by no means destitute of a share of logical reasoning, on the strength of experienced associations of phenomena. In their wild state, and on limited, and, on the average, the same occurring associations, no progress is observable; while, under the varied conditions of domesticity, which frequently are systematically contrived for the purpose of training, their scope becomes enlarged by the increased number and the varied qualities and combinations of associated phenomena.

A logical deduction is the qualification of the questioned ultimates, or effects, by the known or granted fundamental relations or causes. Where the fundamental relation is itself the *question at issue*, and the granted ground to proceed upon is the ultimates or *effects*, logic can find its application only after the fundamental idea, purporting, by its consequences, to cover the phenomenal effects, has been advanced. The fundamental relation once conceived, and its applications likewise advanced, then it is, indeed, by LOGIC, that, *following* the achieved conceptions in their track, we test their bifarious or polar consistency, with the advanced positions, by *syllogism*, on the one hand; and, on the other, with the phenomena, by *identifying* the advanced and logically consistent consequences with the respective real effects; logic proceeding, like judgment, from both the purpose and its realization, present in either, and, when subsequently rendered manifest, representative of both in one act. ("Weisuugen mos. Schpf.," Ws. 6, 7, 8.)

The purported explanatory relation being the more fundamental one, for that very reason it can not be arrived at by deduction. Therefore, in the attempted explanation of causes, themselves not directly observable, and hence requiring to be *inferred* or "construed," it is absolutely a *contradictio in adjecto* to require the conception thereof to be originated by logical *deduction*, in the manner of syllogism; but, as far as logic is concerned, it has to test the sufficiency and efficacy of the preconceived fundamental position, and of its synthetically conceived applications, on the grounds of the *assumed* cause, on the one hand, and of the established phenomena on the other.

The introduction of the explanatory idea is essentially synonymous with hypothesis, suggestion, conjecture, or *theorem*, which is the basis of the "understanding" ("Verstaendniss"): these very terms being in most instances expressive of something *introduced in order to sustain*. The popular expression of "jumping at a conclusion" essentially implies not the enactment of a deduction or actual conclusion, but the *anticipation of a correct fundamental relation*. In a like manner, the consciousness of this anticipating nature of causal surmise is expressed in the idiomatic phrase, "I guess"; and the anticipated correspondence with effects, in its equivalent, "I expect"; while the Greek language signifies the optional proposition by "*men*," and the subsequent reflection thereon by "*de*."

It is only by a faculty of explanatory suggestion, that is antecedent to logical test and prepares the matter and ground for the operations of the latter, that the human mind can enter into the essential constitution of phenomena by the *conception of fundamental relations*, which, it is presupposed, will prove true in their subsequent synthetic applications; and which, if successful in covering the dependent phenomenal ground, actually amount to nothing short of an intuition or actual divination. The science of correct hypothesis, or of *truthful anticipation*, would indeed be the science of sciences, the invention of inventions; for it is on this *promethean* faculty of *a priori invention* (of true relation) which produces the matter for subsequent logical scrutiny (e.g., syllogism and identification), that essentially depends all efficient action, or actual *progress*, in scientific, artistic, and executive pursuits; whereby an unbounded progress into the depths of causes and the survey of their dependent phenomena (B. Peirce, *abv.*) is rendered possible; and such is the power and domain of *hypothesis*, the vital factor of intellectual progress, by its actual vein of INTUITIVE UNDERSTANDING. ("Die Sehergaben," Leipz., Fr. Fleischer, 1842, p. 62, etc.)

Truth, as the intellectual representative of reality, being generated from within, at the prompting of the objects to be comprehended, nothing can be more conducive to its origination than the abundant supply of the objective matter, the first step in *analytic research*, which consists in perception; analysis by classification into categories, comparison, hypothesis, synthesis, and logical scrutiny. It would appear that the chief characteristic of induction consisted in the *establishment of coördinately component objective conceptions*, so that an idea being advanced and ascertained with one of them, the synthetic application may be tried on all the rest; and if ascertained on all the rest of the coördinate conceptions, then it is predicable as a common feature or "law," those coördinate conceptions comprising the *whole known subject* by being its component integrals.

It is therefore required, first, to establish all the ultimate objects under consideration, as, in organographical classification, the *individuals*, as coördinate conceptions and which comprise the whole subject. Next, by the conception of *hiatus* without, and *transitions* within, and that do not admit of demarcation, the idea of the "species," i. e., *type of individuals*, is made coördinately to comprise the whole subject once more. A certain character being once conceived as obtaining in respect of one group of species, if the same character hold good in its synthetic application to the coördinates, the other species, it will likewise produce coördinate groups, comprising, once more, the whole subject; and another platform is gained, on which to realize a law *exhaustively*, because comprehensive of the whole subject at issue. By such a graduated process of conception of coördinates, the most complete amount of objective matter to be understood is afforded as an excitant to the intuitive faculty; and every advanced position may, at once, be exhaustively applied by an application on all the coördinates concerned.

It is thus, that, by a systematic graduation of the subject, that subject itself is rendered as complete and available as possible, provided the *motives advanced* for such coördination be themselves aptly conceived, which remains a matter of intuitive device, not one of deductions. The subject being thus prepared and made available, still it by no means guaranties any subsequent excellence of explanatory hypothesis to be introduced. Indeed, experience has shown, that many anticipations, or inferences, largely "jumped at," have proved, in the end, more real, efficient and productive than a great many others that were more elaborately conducted; for these, too, no less, in every one of the preliminary as well as essential steps of induction, just as necessarily and infallibly involve some predetermined drift or purpose, some *mode of view*, or "turn of mind," in each particular partial enactment.

A remarkable instance of the prophetic energy of truth, striving to embody its creations on the objective materials, is afforded, on a closer consideration, by the Linnean numero-sexual system of vegetable classification. The boding truth of a paramount sway of *generation* and *number*, in the "*phytic*" kingdom, (compare, also, *Phyllotaxis*, last No., and Proc. Am. Ass'n, 1857, p. 81.) is evidently contained in it as a truthful, and hence upholding, vital element, however, in that application and in its identifications with the object at issue, viz., natural affinity, in many cases, glaringly at fault; this especial embodiment representing only, as it were, the footprints and perishable, because inadequate, phenomenal form of a giant Truth *wandering* there, and whose powerful vital factors it has withal served to *impress* and *propagate* beyond any doubt, and, in this involute form, has rendered universally known and universally suggestive. Indeed, as A. v. Humboldt remarks when complaining of the perishability of hypothetical ideas once considered infallible, in most cases it was only the ultimate embodiment or formulation that perished, the nucleus of a true and powerful thought persisting to this day, under its various modern embodiments; in any case, a proof of the production of actual truth from within the mind, and not as a deduction from, or passive consequence of, the objective phenomena.

Language, in its significant appreciations and classifications of ideas, conveys and involves the repeated and multifariously digested opinions and modes of view of millions of intellects, and of more or less qualified observers and thinkers; and, doubtless, owes most to the prophetic imagery of poesy. It is, in many cases, by its prôfound philosophical conceptions, chiefly manifest in the symbolic application of figures, a fertile, although imperceptible, source of intellective suggestion; being, in a remarkable manner, borne out by the final scientific view of the respective cases, e. g., in the idea of *sharp* air as productive of those maladies now with probability ascribed to the agency of the *ozone* state of the atmospherical oxygen, or in that of *pith* or "*marrow*," as the natural figure for the emanative axis of vital power, borne out as such by the scientific consideration of the great nervous centres, no less than by the succulent marrow of the young vegetable sprout being now recognized as the primary organ of vegetable organogenesis, the new radial elements springing up at the succulent terminal marrow-core originating the bud, and ultimately contained within it (Schacht). Whether the same or a corresponding character will not hold good with the "marrow" of fistulous bones, likewise, remains for the future to show.

A truly philosophical view of any subject can alone cover all emergencies; an intrinsically consistent one alone can stand forever, and, if once assumed, be maintained in universal circulation and elaboration as above remarked. Not so with classifications, or, points of view, exclusively diagnostic, utilitarian, or inconsistent, because in many of their applications apt to fall short.

It is thus that philosophical designation, or classification, becomes a momentous feature in human progress, so that by their very languages, or typified ideas and modes of elaborating the same, ages and nations can be known as to the tendency and degree of their general attainments and intellectual height.

Physiography.

For the purposes of identification by differential diagnose, and for that of total representation, two modes of considerable difference are practically in use--*Description* and *Definition*.

Definitions purporting effectually to render the essential characters and unimpeachable demarcations of phenomena, they require a perfect ultimate representation, and hence a knowledge of the fundamental conditions, so as to cover all the phenomena, under all conditions, in the manner in which a logical or mathematical assumption covers all the consequences therefrom derivable.

The specific or distinctive fundamental conditions of the phenomena of *organic action and existence* remaining, as yet, occult, the possible scope and limits of organic phenomena can not be developed *a priori* in a synthetically deductive way, but require to be experimentally circumscribed and analytically ascertained and recorded; and this is the province of DESCRIPTION.

ORGANOGRAPHY.

Descriptive efforts, or the record of observations made, have, it is to be regretted, in organography, as yet been almost exclusively confined to the collection and assortment of *diagnostic* material. Observations on the especial and general economy of organic life, the *knowledge par excellence*, viz., of the *connexion* of organic phenomena, the due repository of which is Natural History, are mostly lost for want of an opportunity to record them, and through the comparative neglect in which, by a strange misconception, Natural History seems to be held by the generality of students; while it formed the chief object with the fathers and regenerators of botanical science, as with Theophrastus of Eresus, Dioscorides, Brunfels, Bock (Tragus), Fuchs, Corda, Tabernæmontanus, and with Gesner; to the latter of whom, also, the honor of the first steps in natural classification seems to be due. In Natural History, Linné and Buffon stand perhaps unequalled to this day. By his intellective suggestions, truly prophetic, *Goethe*, the poet, seems to have been the principal founder of *vegetal* as well as *vertebral morphology*, although it was reserved to others, acquainted with the specialities, fully to establish in their correctness, and deductively to apply, the positions so beautifully advanced by him, e. g., in his poem, "Die Metamorphose der Pflanze," and, concerning the mutual relation between the elements of the skull and of the vertebral column, in his correspondences. New and spirited points of view have been started by Schouw, and chiefly A. v. Humboldt; the former, concerning the physio-geographical, the latter, no less concerning the moral, ethnological, and statistic relations of the virescent world; while the intrinsic or causative, and the extrinsic or ultimate, philosophical relations of vegetable economy, such as development (H. Mohl, Schacht, Reisseck), organotaxis (C. Schimper, A. Braun), morphology (W. v. Goethe,

G. W. Bischoff, G. Engelmann), vegetable migrations (Unger), geography and scenery, as specialities, are more and more cultivated by the numerous devotees of Flora. A beautiful contribution to the natural history of plants we find in the monograph on the Palm tribe by B. Seemann, Ph. D., and since A. v. Humboldt has, in his "Kosmos," given us a Natural History of the physio-sensuous Universe, C. Mueller, in his "Versuch einer kosmischen Botanik," an essay on the extraneous relations of vegetable types, and Schleiden ("Die Pflanze und ihr Leben") one on their intrinsic and æsthetical ones, we need not despair of seeing Natural History once more resume its catholic dignity as the text-book of both the intrinsic and extrinsic relations of the efformative kingdoms, and of the organographical and botanical parts, *in specie*, of the Great Economy, or "Kosmos"; but to hold its purposes in disrespect argues nothing but a misapprehension of its objects and character.

Affinity.

If we consider, without prejudice, on what grounds all artificial criterions and systems thereon based have been advanced and in part adopted, it is mainly because they were, at first, conceived to be, to a certain degree, coincident with "natural," *actual*, or intrinsically and catholically THOROUGH SIMILARITIES. The individuals and species we are not enabled as yet to construe synthetically, or define: we but know them as prompted, in a concrete and complex condition, on occult grounds of unity. The variabilities in the parts of the individual, those within the range of actual congeners as well as within the species, afford numerous examples whence to conclude, what may be the more variable and what the more constant, and hence, probably, the more essential or grave characters under the present average conditions. In a comparison as to total or "thorough" resemblances, called "affinities," we are rarely at a loss on such evidence *which* individual totals to claim as the *closer*, and which as the more distantly *related* among a number in question.

Natural Classification being based on the evidence of catholic constituent relations, it *eo ipso* affords a most fertile ground for the conception of cosmological or catholic ultimate relations in organography. The *De Jussieu*, *Bernard*, the founder, and *Antoine Laurent*, the monographer, of natural Orders in botany, since 1758, in resuming the primitive question, viz., of closest total resemblances, were so successful in the groupings they advanced, under the name of "Orders," that most of their arrangement has ever since been received, because *re*-conceived, no doubt, at the prompting of their arrangement; and their "Orders" have withstood the futile attempts at synthetically defining, by isolated abstracted character, what never was the offspring of synthetic argument, but of *comparison;* and although authors have adopted their arrangement, yet, in contradiction to their very principles of total correspondences, the Orders are subdivided on partial criteria, often gratuitously selected and quite inefficient.

The process, by which I arrived at my results, was one of strict analytical inference. On a received suggestion of *linear* connexion, I arranged the adopted natural orders and single erratic forms, elevated, *faute de mieux*, to the rank of Orders (Tamarix, Coriaria, Calycanthus, Punica, Podophyllum, Thelygonum, Datisca, and the like), after the fundamental rule of natural affinity, applied to serialization, viz., closest total coincidence of characters; the dignity of each character being partly as an impression of judgment derived from their comparative values of constancy and variability on the individuals and within the species, and withal from the relative part they assumed, *a posteriori*, viz., *subsequent to the juxtapositions* of species, genera, orders, etc., on the fundamental leading principle of affinity, thorough correspondence.

On the ground of established Orders, such as Ericaceæ inclusive of Vaccinieæ, Nymphacaceæ inclusive of both Nuphar and Victoria, and Rosifloræ inclusive of Dryadeæ and Pomaceæ, I drew the conclusion, that in these cases the difference between hypogynous and epigynous forms was subordinate to that of the assumed Order, and likewise, that these forms, by gradual transitions (Nuphar, Nymphaea, Victoria; Pyrola, Gaultheria, Vaccinium) through *mediating* forms connected much closer among each other than such forms as, e. g., Papaver with Erica, although alike hypogynous. The fact obtaining in several granted instances, I ventured the hypothesis, that *every hypogynous form might connect with epigynous ones*, and *thus*, perhaps, a *series by immediate connexions* (natural series) be realizable.

Synthetically starting on this proposition, mentally constructing epigynous forms to given hypogynous ones, and *vice versa*, I was charmed to find that these fictions had their strict correspondencies in reality. As an hypogynous form of Calycanthus, I devised the very counterpart of Illicium of Magnoliaceæ. As a *sub*hypogynous form of Cacteæ, Portulacca, as a *sub*epigynous one, the apex of the carpels not being covered by the coherent calyx, as likewise in Mespilus of Rosifloræ, I recognized Mesembryanthemum, of which the hypogynous forms must be Crassulaceæ. I had known Bartonia, when in Spain I found that Glaucium luteum may stand as an hypogynous Bartonia. Papaveraceæ connecting, on the one hand, directly with Fumariaceæ by such forms as Chelidonium and Hypecoum, and on the other, through Bocconia and forms like Isatis, with Cruciferæ, the *aditus* between Papavera ceæ and Bartonia (Loasaceæ) seemed to be precluded. How-not, therefore, be esteemed stringent ones, but only of a conditional value. What I find to be far more indicative, is what is called *habit;* for, however multiform within an established Order, still every natural Order, or group of Orders, has its highly impressive, although scarcely describable *character of habit.* By habit, Umbelliferæ thoroughly connect, on the one hand, with Araliacaæ; on the other, with Gruinales. From either of the other affinities remarked, they are emphatically distinct by habit—least so from Begonia. Corneæ, by habit and immediate continuity of total correspondences, connect, on the one hand, with Nyssa, in fruit and habit representing an epigynous *olivaceous* form; on the other, with Rubiaceæ, which, through Lonicereæ, Hydrangea, and Valerianeæ, conduct us to Dipsaceæ and Compositæ: so that Corneæ appear as an epigynous phase intermediate between Tubifloræ (Auct.) and Synanthereæ. Ribes, presenting another partial affinity to Umbelliferæ, on the one hand, directly connects, by the forms endowed with a long, tubularly produced and petaloid calyx, with Fuchsias of onagraceo-salicario-myrtaceous affinity; on the other, through the mediation of Escallonia, with Saxifrageæ. Begoniaceæ by their anthero-connectival fabric indicate a close relationship with anonaceo-hydrocharideo-nymphæoid forms, an affinity confirmed by the *serpentarioid,* flexuoso-nodulous stem, the liriodendroid stipules, and cissoid and victorioid foliage, of a certain Begonia, and, if considered hypogynous, would, in their triquetrous capsule, alate seed, apetalism, and tufted stamination, represent the floral fabric of *Nepenthes*, itself of aristolochioid affinity, while, by its pitchered leaves, directly belonging to Sarracenias and Dionæas. An affinity of Begonia to Euphorbias, by a divided stigma and inequilateral, spotted foliage, also deserves consideration, but stands *unmediated;* while Euphorbiaceæ themselves by their cupulate forms immediately connect with Ficoideæ, on the one hand, and in their crotonoid forms, on the other, most probably with Daphnoids.

The foliage of *Cissus*, its stipulæ and habit of stem, which appears to be composed of very distinct bands, or columns, of ligneous tissue, as in Vitis, unites the forms of Vitis and of the flexuoso-nodulous-stemmed Viola species; the whole of the ligneous tribes of Violaceæ, so abundant in the interior of Guiana, judging from Schomburg's specimens, likewise insinuating the subcordate, acuminate, oblique-sided, underneath roseate, foliage of Cissus versicolor and certain Violæ, an affinity also confirmed by the occasional *apetalism* of Viola pubescens, *Ait.*, at certain seasons. I thus obtained the following partial file of closest connections: Umbelliferæ, Araliaceæ, Ampelideæ, Violaceæ, Resedaceæ, Parnassia, Droseraceæ, Amphoratæ (sarracenio-nepenthoids), Begoniaceæ, both of the (epigynous) *termini* being of a multifariously related type, and the whole (Vitis, Menispermum, Leontice) claiming an affinity to the magnolioid tribes. Magnoliaceæ by Illicium initiate the calycanthoid type, in its resinoso-camphoraceous properties and habit at once indicative of both a magnoliaceous and an asaroid affinity. In Eupomatia, as described by Endl., I find a meloniferous aristolochoid form, uniting the indumental and staminal parts of (perigynous) Calycanthus in an epigynous version, with the carpic character of Aristolochia. Next to identical in floral structure with Calycantheæ are (Endl.) Monimiaceæ of lauroid affinity. Laurus Benzoin and Laurinæ generally have the resinoso-camphorate property of Magnoliaceæ in their fruit, and partly in their foliage (L. Benzoin, Asimina triloba). The spotted, curved and smoothish branches of Laurus Sassafras are those of Magnolia glauca. The antheral valve and floral texture of Laurinæ we find in Berberis, a *four*-celled anther in Menispermum, likewise,—all of magnolioid affinity. It is but natural, that most of my devised affinities should be based on the habitual impressions derived from the vegetation of the United States and the south of Europe, those conveyed by *the habitual forms of central Europe having already served the European botanists* to group forms around their starting-points, mostly indicated by the very name of the Order (Ranunculaceæ, Berberideæ, Rosaceæ, Geraniaceæ, etc.), until at last a breach ensued; which breaches, *if* a natural series of total connections does exist, *must* naturally be supplied by the vegetations of other countries, less consulted, because less frequently prompted to contemplation by frequent accidental occurrence.

If we consider the enormous difference of seminal structure between forms so closely allied as Papaveraceæ and Cruciferæ, and as Cæsalpineæ and Papilionaceæ of Leguminosæ, a similar one between Laurinæ and Magnoliaceæ can give no ground against their affinity; and Linné, in recognizing the significance of embryonal structure, seems not to have expected as much importance from the seminal induments and deposits, which properly belong rather to the old than to the young plant, by becoming effunct as the latter assumes an independent vital existence.

Magnoliaceæ, through Anonacea, Schizandraceæ and Menispermum, connect with Berberideæ; and the latter, through the berried forms of *Actæa*, etc., join Ranunculaceæ. Ranunculus Flammula, by its habits, and the catervated, lenticularly rostate, monospermous carpels, being highly insinuative of Alisma and Sagittaria, I examined the latter as to its cauline structure, which, as I had thence anticipated, actually proved to be an *exogenous* one! Even before then I had been diffident of the alleged monocotyledonous character of Alismaceæ and the rest of najadaceous tribes, on account of the number of their carpels exceeding the dominant one of "Monocotyledoneæ," all of which have *three*, with the exception of certain Gramineæ. The (magnoliaceous) *stipules* of Potamogeton seemed likewise to contradict that location. I have not yet been able to satisfy myself of the actual embryonal structure of Alismaceæ. The horse-shoe seed seems to present quite as homogenous and grumous a mass as the albumen of Nymphacaceæ, although cartilaginous in the former. At the butt end I found a tubercle, which I would compare to the *amniotic sacculus* as observed in the allied Podophylleæ, Anonacea and Cabomba.

Hydrocharideæ, most intimately connected with Nymphacaceæ, besides the foliage and epigynism of certain Nymphaceæ, afford the *parietal placentation* of Nymphæa, Hydrocleis (Najadeæ), and, more distantly, *Cruciferæ*(*!*), combined with the minutiæ of Najadeæ, the epigynous form of which I claim them to be, and to which (compare the antheral structure of Cycnogeton Huegelii, Endl. Iconogr., and Triglochin) Juncagineæ, no doubt, belong, as the connecting link (Scheuchzeria and Butomus) to Alismaceæ; while, perhaps, Burmanniaceæ require to be added to the dependencies of Hydrocharideæ. In habit, Schollera of Pontedereæ likewise belongs here, representing, as it were, a perigynous Zostera by the habit and texture of its stem and foliage, while the sagittaria leaf and the densely clustered spike of Pontederia likewise recall the najadeous tribes generally, so that the "Order" of Pontedereæ is likely to prove the perigynous form of Hydrocharideæ, connecting them with hypogynous Fluviales, Endl. I have not yet been able to examine fully the rhizoma of Pontederia, but *those of Nelumbium and Nuphar are strictly endogenous!* In Podophyllum peltatum, the perennial rhizoma is perfetly exogenous, while the herbaceous floriferous *stem*, which alone is exserted, bearing a terminal flower between two opposite terminal leaves, has the structure designated by "endogenous." In a specimen of Hydrocharideæ, as well as in Sagittaria, I find the caudical structure to be clearly *exogenous*, and as Nymphacaceæ, by their epigynous forms, seem immediately to connect with Hydrocharideæ, the two may be claimed as the *connecting links between Monocotyledoneæ and Dicotyledoneæ;* the hypogynous nymphæoid forms, such as Nelumbium, Cabomba, and perhaps Myristicaceæ and Saururus, by their seminal structure closely allied to Piperitæ, and perhaps no less (Saururus) by habit, confirming the position advanced by authors, that Piperitæ seem to mediate the monocotyledonous and dicotyledonous forms by transition.

We have thus threaded the file of Dicotyledons back to its monocotyledonous connections, which we found to be mediated by Nymphæo-Hydrocharideæ, towards the dicotyledonous side dissolving, as it were, their *pomal* (epigynous) *fusion of* *floral parts* into the eleutheromerism of najadeo-ranunculo-magnolioid forms, perigynous in Monimiaceæ and Calycantheæ, and arriving at an epigynous ("pomal") *dividing ridge*, so to say, in meloniferous Eupomatia, Serpentariæ and succulent Begoniaceæ. The latter seem to be, in an hypogynous version, represented in Amphoratæ, of which Nepenthes has the alate seed of both Begonia and certain large-podded Violaceæ, and the triquetrous capsule of Triglochin and Reseda. Reseda imagined apetalous and its pendent fruit turned upwards, we have the (melanthoid!) image of a Nepenthes inflorescence. No doubt Parnassia, by its fimbriate petals, is of all violoid forms most closely allied to Reseda; through Violaceæ and other cissoid forms, such as violet-leaved and scented Ampelideæ, we arrive at epigynous Hedera, whose foliage is foreshadowed in Begonia Dregei, while Araliaceæ, Umbelliferæ, and probably Vochysiaceæ, form the dividing node towards Gruinales and Rhœades, Endl., epigynously terminated by Loasaceæ, whose pinnatifid, cucullate forms, such as Cajophora, unite in themselves somewhat the striate fruit and clematoid habit of Umbelliferæ and Fumariaceæ—a sort of *recurrence of type* observable in *all* "pomal" forms, on trial of the suggestion; thus in Loasaceæ we likewise see, by Bartonia, the floral habit of Cereus and Opuntia foreshadowed—the head of a Cactus on a capparoid body, so to say. It is thus that both *termini*, or pomal dividing and connecting *nodes*, of these orders may be conceived to *join at their ends*, forming a "circuit" or "cycle"; and the application of this idea holds good on all the others, as we shall presently see, and therefore may be held a "law." Likewise, the forms contained between the "*nodes*," or pomal forms, may be stated to be rather homogenous, or uniform of habit as well as floral structure, such as the "rhœadoid" and "polycarpic" Orders are within themselves; and this conception, applied to the other "internodes," or circuits, holds likewise good; so that the circuit itself can be said to be constituted by a *homogeneity of habit*, as to the somatic part; and an eleutheromerous anthic structure, in two directions gradually transforming into symmerous and finally epigynous or pomal ones, of approximate types, but not immediately mediated by transition, and likewise *offering striking resemblances to probably all the other epigynous forms*, by a remarkable *variability* of floral structure in each epigynous phase.

Amarantaceæ, Chenopodeæ and Polygoneæ have, from a great coincidence of habit and embryological character, and chiefly by immediate connexions, such as through the spinous utricular perigons of both Emex and Spinacia, between Polygoneæ and Chenopodeæ, and by the ambiguous form of Camphorosma, between Chenopodeæ and Amarantaceæ, been accounted, as a connected whole, as Oleraceæ. Nyctagineæ, by habit no less than by their seminal structure and petaloid calyx, likewise apetalous, are mostly considered *affines* to Polygoneæ, to which as well as to Amarantaceæ (Amarantus deflexus, Herniaria glabra) Paronychiaceæ likewise claim a great affinity, so striking between such forms as Paronychia nivea and polygonoides on the one, and Polygonum aviculare and some more bracteate ones of the Mediterranean region on the other hand. The calyx of chenopodiaceous Salsola likewise represents that of Nyctagineæ, and no less that of *Statice*, rather incongruously and artificially united by authors with polemonioid Plumbago. The dense crests of scarious inflorescence of Statice approximate the genus likewise to Amarantaceæ, its capitate clusters to capitate Dianthus. In the German language, popular appreciation makes Statice a "sand-pink." By the frequent view, in Spain, of such highly petaloid forms as Statice sinuata, with a blue, and S. ægyptiaca, with a white, petaloid calyx like that of Mirabilis, I was strongly impressed with the coincidence, suggestive of the idea, that the one was an apetalous form of the other, both coming, by the eleutheromerism of Statice, under the dialypetalous, not the tubiflorous, affinities.

Frankeniaceæ, in every respect except the presence of petals, belonging to the neighborhood of Nyctagineæ, by these combined characters likewise join Statice, as well as Scleranthaceæ of Dianthoids. Frankeniaceæ have the fleshy, farinaceous, foliar texture of both Polycarpon and Chenopodiaceæ, and in habit, stipulæ, etc., most closely join Paronychiaceæ, and recall Alsineæ. According to Endlicher, they may also be somewhat compared to *Tamariscinæ*.

The hippocrepiform embryo in a farinaceous albumen, the scarious texture of capsules, the ciliate filiform stigma, the flexuous stem of Polygoneæ, and many characters of habit undefinable, have caused the prevalent assumption of a correspondence between Oleraceæ and Dianthoids. To my mind, an actual connection is mediated through Paronychiaceæ (and Frankeniaceæ) between Polygoneæ and Callitrichineæ, Batis, etc.

As in Dianthoids we have forms with a tubiflorous and an eleutheromerous calyx, so in Statice we have a nyctagineous one, in Armeria the sepals of *Linum*, with which it would seem to connect by the multiple number of fused carpic elements likewise, as in habit generally. Such forms as Linum (sp. *of Lisbon*), with its rigid and projecting calyx, also recall Alsineæ. The yellow, arborescent, tristylous Linums no doubt closely approach the tristylous Hypericum species, while the proximity between Hypericinæ and Alsineæ + Portulaccaceæ seems to be indicated by Elatine, uniting the habital characters of Mollugo with the rippled seed of Hypericinæ.

In the neighborhood of tricarpic Hypericinæ we must perhaps place Cistus and Helianthemum, by their membranaceous, costate calyx, partly *spirally twisted*, and scabrous feel, seem to hint at Loasaceæ, while the resinous, ladaniferous character recalls capparid properties on the one, and the viscous exsudation of Lychnids on the other hand. A position for Cistinæ might also be sought for near Tiliaceæ, where a similar valvate dehiscence (Sparmannia) and similarity of stamination, as well as of foliage (Byttneriaceæ) obtains. The same, nearly, might be quoted for Hypericinæ, by habit so far distant from Tiliaceæ, notwithstanding a polyadelphous stamination. An autopsy of Hypericum calycinum and Bartonia must decide in favor of loasaceous affinity for Hypericinæ, and perhaps for Cistinæ.

We thus might assume the following linear connection:—Loasaceæ (with Bixaceæ? Turneraceæ?), Cistinæ, Hypericinæ (Ochranthe?), Linum, Armeria, Statice, Nyctagineæ, [Polygoneæ, Chenopodeæ, Amarantaceæ, Paronychiaceæ?] Frankeniaceæ, Scleranthaceæ, Diantheæ, Alsineæ, [Elatineæ? Callitrichinæ? Batis?] Mollugineæ, Portulaccaceæ, Cacteæ, the latter the epigynous form of both Portulaccaceæ on the one, and crassuloid Mesembryanthemum on the other hand, Cereus with Bartonia *formally* rounding off this *cerastoid circuit*, while essentially disconnected for want of links for immediate and closer transition than the very one through Dianthoids and Linoids.

In a communication, last year, on the kind request of B. Seemann, Ph. D., made on this subject to the Linnean Society of London, the whole of the series, from Paronychiaceæ + Callitrichinæ, Batis, Elatine, etc., through Oleraceæ up to Tamariscinæ and Salicinæ, are intercalated between (epigynous) Cannabinæ, Platanoids, etc. That Salicinæ may, by the identity of the fruit and seed, be justly claimed as apetalous depauperated forms of Tamariscinæ, is justifiable by a like comparison between perigynous Acer and monœcious, apetalous and merely *bistaminate* Negundo, the evidence of which likewise refers Fraxinus, by its single samara a semi-Acer, or semi-Negundo, to that neighborhood. Whether Tamariscinæ + Populinæ, + Reaumuriaceæ, belong to the *amentaceo-ficoid* tribes rather than to the *cerastoid* ones, under discussion, I am not prepared to say, although a connection between Tamariscinæ and caudate Amarantaceæ has been pleaded by me. As they stand as yet without any evident connection, they may stand where authors have generally referred Populinæ, namely, in the neighborhood of Cupuliferæ. Perhaps the mediating links may yet be conceived among the known ones, or hereafter be discovered. Among Chenopodeæ, there are strong indications of urticoid affinity afforded by the mulberry-like carnified perianth of Blitum, the platanoid piluliferous aments of Obione bracteosa (Pl. Heermann.), the platanoid foliage and habit of

Atripliceæ, the leafless articulated stems and depauperated flowers of Salicornia, recalling artocarpoid Casuarina, to which Halorageæ by their verticillate, amentoid stems also seem to claim affinity. If Myriophyllum can be justly claimed an epigynous callitrichine form, on the ground of its habit and the quadricornous fruit, then probably the whole of Oleraceæ and their dependencies belong thither, namely, to Amentoideo-Ficoideæ; an affinity likewise borne out by the spike of Polygonum, when stripped of its flowers, its *ocreal bracts* giving the exact prototype of the scaly male aments of Carpinus and Populus; and if, as above remarked, the oleraceous type requires to be referred thither, the connection is no doubt afforded by Halorago-Thelygonoids, Cannabinæ and Cupuliferæ on the one, and Gomphreneæ, Tamariscinæ, Populinæ and Platanoids on the other hand: a question I must now leave undecided.

In any case, Alsineæ, by Polycarpon and perhaps other verticillate forms, approximate Mollugo of Portulaccaceæ, the (sub)hypogynous Opuntias. Diantheæ, Frankeniaceæ, Statice, Linum, Hypericinæ, (Bixaceæ?) and Cistinæ, seem to join Bartonias, and the whole passage may be designated as the *dianthoid type*.

Cacteæ, Mesembryanthemum, Crassulaceæ, Cunoniaceæ, Saxifrageæ, Escalloniеæ and Ribesiaceæ form one uninterrupted file and succession. The foliage of Escallonia foreshadows both that of Ribes aurea and Fuchsia græca. Ribes rubrum, in its flower, stem and foliage, offers a resemblance to Acer Pseudoplatanus and others, as well as to Hydrangea, whose close affinity to Viburnum Opulus, however, secures it essentially to the lonicerous neighborhood. The rostrate Ribes recall, by their long, tubulate, petaloid calyx, together with Fuchsias, which they essentially join by catholic connection, the (fuchsioid) type of Gymnocladus, so exceptional among Cæsalpineæ, and the calycine proboscis of Serpentariæ, the nodal point between Magnolioids and Amphoratæ.

In Ribes aureum, besides the tube and erect petals of Fuchsia, we have the heavy caryophylline aroma of both the pink and clove. The berried Onagraceæ join Ribesiaceæ in habit and particulars, while those of ringent corolline structure, as Lopezia, join Melastomeæ, with truncate capsule attached to the calyx merely along the nerves of the latter, so as to initiate the hypogynous form of Salicariæ, while reflecting somewhat on the vittate fruit of Umbelliferæ, and the truncate epigynous berries of Hedera. As a remarkable coincidence in habit between Melastomeæ and Salicariæ, Centradenia rosea and Cuphea viscosa may be mentioned. Salicariæ assume a campanulate tapetal calyx in Lagerstrœmia, highly resembling the otherwise epigynous one of Punica, and the membranaceous, crumpled petals of both we find in Cuphea cordata likewise. In Bertholletia excelsa, of Myrtaceæ, we find the calyx of Punica, indurated and coalesced with the capsular elements, thickened, with the external appearance of a gigantic walnut, which belongs to another, disconnected, epigynous, and at the same time cupulate type. Bertholletia bears a wooden bomb-shell, filled with large oily seed, in resemblance to Juglandeæ. In other Myrtaceæ, as in Metrosideros, we have a subsucculent, woody, truncately-dimpled, myrtaceous *pomule*, with the insignificant seed of Salicariæ. Leptospermum offers a most striking resemblance in flower, by its orbicular petals and dense brow of stamina, to the rosaceous forms, such as Cratægus, while the fruit of Myrtus itself resembles an Amelanchier's. Combretaceæ seem to join Myrtaceæ, and Philadelphus likewise. Philadelphus repeats the square form of Ludwigia, of Onagrariæ, and seems to formally round off the *myrtiflorous* circuit back into its commencement, while repeating the caryophylline odor of the preceding *dianthous* (pink), *saxifragous* (Ribes aur.) and *myrtoid* (clove) circuits. Deutzia, of Philadelpheæ, is tubiflorous. The stamination of Philadelpheæ approximates them, besides the quaternary, and, in Deutzia, tubiflorous type, to Halesia, of Styraceæ. The bud of Philadelphus (Zimmtrœschen) resembles that of the rose, its stamination that of Citrus.

Styraceæ and Vaccinieæ are epigynous Ericaceæ, of which the rigid foliar type, and truncate, epigynous berry, as in Vaccinium, sufficiently resembles the myrtaceous ones; and, by correspondence without connections, as habitual with epigynous types, it likewise recalls Melastoma, Viscum and Hedera. Through Philadelpheæ and Styraceæ the mediation is perfect, and it is here that Hydrangeæ, by multiple stamina, might claim a place. But the multiple stamination we also find in diœcious Nyssa, an epigynous *olive*, at the other or rubioid extremity of Tubifloræ, where Hydrangea belongs, and of which Symphoria likewise formally rounds off the circuit with Vaccinieæ, as Hydrangea does with Philadelpheæ.

Vaccinieæ, Rhododendreæ, Ericaceæ, Epacrideæ, Sapotaceæ, Ebenaceæ and Myrsineæ are known to connect. The latter, by their rostrate stamination and stellate corolla, join Primulaceæ and Solanaceæ—Primulaceæ, directly, in the Lysimachia and Anagallis type. To Primulaceæ, no doubt, belong Pinguicula and Utricularia, as ringent forms. Solanaceæ are known to be the closest allies of Primulaceæ. By the prickly capsules of Datura and Josephinia, Solanaceæ and Pedalinæ connect, an affinity borne out by the throughly hyoscyamine habit, although gloxiniod flowers of Martynia, whose stratified podded capsule connects no doubt with Eccremocarpus of Bignoniaceæ, followed by podded Crescentieæ and Gesneriaceæ, by Myoporinæ connecting with Scrophulariaceæ, merging, through Mimulus and Tozzia, into Rhinanthaceæ. The lower, ovate, entire, longitudinally nerved, radical leaves of Castilleja coccinea are the forebodings of Plantago, while their cauline ones are those of Hebenstreitia, of Selaginæ. No doubt Rhinanthaceæ merge into parasitical Orobancheæ and Cytinus, the latter possibly of a Balanophoreæ affinity, as Endl. has it, but, by the most stringent *connections*, of an orobancheous character, the calyx however consisting of two sejunct sepals, in the axil of a bract, according to the comparison with its immediate proximates. That the embryo should be undeveloped, or in a fungous coalescence, seems not strange in a parasite, where pallid, fungous sponginess is a frequent character, but can never, as an isolated character, decide a diremption contrary to the most complete evidence of all other characters, as in this case.

The subscarious flowers and erect spike of Acanthus connect the orobrancheous forms with Stilbinæ and Selaginæ—the latter a labiate, orobanchoid modification of a pinnate-incised-leaved Plantago. If we find and acknowledge regular tubiflorous forms, such as Lycopus and Isanthus, among Labiatæ, a distinction need hardly be made between Selagineæ and Plantagineæ. Also the hypocraterimorph, scarious, quadripartite corolla of Ajuga Iva, of Spain, is the very one of Plantagineæ.

Plantago bracteosa, and Plantagines generally, are in every respect the *acaulis* form of such types as Verbena stricta, the straight-nerved, hoary, sometimes deeply dentate foliage and the compact spike corresponding. The capsule is still bipartite in Verbenaceæ, but maturing only four seeds, and adhering to them, in its dehiscence is determined by them. By such forms as Vitex and Lavandula, Verbenaceæ and Labiatæ seem to connect; while in Echium we have a labiate form of Borraginæ, through Heliotropium and Phacelia connecting with Hydrophylleæ. To Polemoniaceæ, proximal to Hydrophylleæ and Hydroleaceæ, naturally seems to belong Plumbago, and, through the mediation of Gilia, also Nierembergia and Petunia. Of Goodeniaceæ I have seen but one species of Euthales, by habit apparently approximating Plumbago.

The connection of Polemonio-Petuniaceæ with Convolvulaceæ seems to be chiefly mediated by such giliod forms as Ipomopsis. The affinity between Convolvulaceæ and Asclepiadeæ, so manifest in the habit, foliage, stem, bast and milky juice of twining Asclepiadeæ, and some of their convolvuloid flowers, seems to be mediated by aphyllous Cuscuteæ, whose affinity, so manifest in the capsule, is universally acknowledged, notwithstanding the deficiency of cotyledons or foliar parts of the embryo, the whole stem being destitute of well developed radial organs, being a parasite like Cytinus above treated. Erycibe (Ericybeæ, Endl.), with the contortuplicate cotyledons of Convolvulaceæ, a sessile, radiately five-lobed stigma and monospermous berry, seems to join dichotomous-styled, drupaceous Cordiaceæ, with plaited cotyledons, and these Nolanaceæ, of convolvulous habit, but with distinct *follicular*, drupaceous carpic elements, and the filiform, annulately curved embryo of Cuscuta. Hither Limnantheæ, with annular corolla-tube and basi-gibbous filaments, seem to refer. Asclepiadeæ connect onwards with Apocynaceæ, with which their affinity with Convolvulaceæ is urgent enough. A remarkable coincidence in both Asclepiadeæ and Apocynaceæ with Bignoniaceæ we find in the podded fruits, psaltered placenta and winged seed: apparently, the type of the tubiflorous capsule, as soon as developed to a sufficient size, and, as it were, only *suppressed*, so to say, in the small-fruited forms.

Apocynaceæ are followed, through the mediation of Vinca and others, by Gentianeæ, through octomerous Chlora and Nyctanthes connecting with Jasmineæ, by habit and floral structure closely approximating Ligustrinæ, Loganiaceæ and other sub rubioid forms. In such forms as Olea and Ligustrum the petals being free, we need not be surprised to find an alternation of free and tubiflorous petals likewise in Corneæ and Rubiaceæ. Nyssa (Tupelo), by its multiplied stamination recalling Hydrangea, and by habit and the color of its epigynous drupe suggestive of Viburnum prunifolium, by its unilocular putamen and *oleiferous exocarp!* represents the transition from Oleaceæ to Corneæ. The latter, through its tubiflorous Cephalanthus, etc., forms, no less than by the eleutheromerous corolla and mericarpous fruit of Galieeæ, are connected onward with Rubiaceæ, whose cinchonine forms repeat, in the epigynous version, the bipartite podded fruit, psaltered fusiform placenta and alate seed of Bigoniaceæ and Asclepioids, affording another example of the versatility, yet latent perdurance, of type, so to say, of the several parts singly; while the bifid stigma and many-seeded, bilocellate fruit vindicate to Hydrangeæ a position in this neighborhood as well as their putaminous forms do to lonicerous Viburnum—both, in their "snow-ball" varieties, naturally only occurring in some of the marginal flowers of the inflorescence, as well as by habit asserting their thorough mutual affinity, and also a more distant one to Scabiosa and certain Umbelliferæ, where a similar *begonioid* development of a rotately flattened, *tetramerous petaloid calyx* likewise obtains. We have spoken of the relation of Hydrangea to Philadelpheæ, also to Ribesiaceæ and Escallonieæ, and its affinity to both Umbelliferæ and Begoniaceæ is one more ratification of the advanced position, started on former evidence, that in each epigynous phase affinities to most, or perhaps all others, will obtain either severally or combined.

Loranthaceæ no doubt require a place in this epigynous community, and perhaps likewise some other obscure epigynous forms, as Garrya (Garryaceæ, Endl.), not essentially required to establish the connection and succession of the chief Orders.

Of Lonicereæ, so closely allied to Rubiaceæ, Viburnum Opulus is a form in its habit and peculiarity of marginal flowers most clearly resembling Hydrangeæ, some of which have a baccate fruit likewise (*abv.*) The pinnate foliage, property and habit of Sambucus closely approaches that of Valerianeæ, in whose occasionally plumose or scarioso-rotate *pappi* we see the peculiarity of Scabioseæ and Synanthereæ introduced.

In herbacious Fedia cornucopioides we see a form intermediate between Caprifolium and Centranthus, and in Fedia coronata the initiation of the Scabiosa type, or Dipsaceæ.

With Dipsaceæ the epigynous character is lost, its pergameneous, pappiferous lageniform calyx being mostly free from the capsule. A most striking feature is the adhering and pappose condition of the *bract* enclosing each flower. Among Synanthereæ this form is designated by "achenia corticata," which obtain in certain Heliantheæ, such as Gymnopsis, Cichoraceæ, such as Zacyntha, certain Gnaphalieæ, and, to my mind, in Calendula, being in every respect a proximal form to Zacyntha. In the apetalous section of Ambrosieæ we find the bracts and involucral elements indurated and coalesced, in Xanthium imitating a beech cupule. The same cortication seems to obtain in the marginal achenia of Calycereæ, to which those of (epigynous!) Knautia orientalis, of Scabiosæ, afford a striking parallel.

In Synanthereæ the epigynous type is resumed, with a change of position in the embryo and an exclusion of albumen, present yet in Calyceræ, the embryo of which likewise is an inverse, not an erect one.

Want of space forbids at present to give more than a mere indication of the internal serialization of Synanthereæ and other extensive Orders, as Labiatæ, Leguminosæ, etc., of which I would hereafter submit an analysis on the principles of natural (analytic) classification.

Such forms as milky-juiced and blue-flowered Cichorium, and Elephantopus, with an unilaterally quinquefid corolla, together with the synantherous character, recall Lobeliaceæ. Probably the capitate forms of Campanulinæ, with minute florets and somewhat connected anthers, such as Jasione, are the next allies to the onward exordium of Compositæ, in its labiatiflorous forms. Within Campanulinæ a sudden change of floral development takes place. Trachelium, by its floral structure, although not by habit, closely resembles Centranthus, of Valerianeæ; and if Fedia did not by closer and more universal connection inevitably conduct into Scabioseæ, and from these into Synanthereæ, an immediate closest connection between Valerianeæ and Campanulinæ might be assumed on the strength of Centranthus and Trachelium. It is evident that the "Aggregatæ" (Endl.) circuit, of uniform habit, is contained between these two terminal points; while in Lobelioids, by the amply campanulate corollas, the trimerous, delicate capsule, the involute placentas and margined seed, as well as acrid, milky juices, and habit generally, the *peponiferous* type is introduced.

The connecting link between Lobelio-Campanulinæ and Cucurbitaceæ is no doubt effected by Columelliaceæ, on a campanulaceous trunk and capsule bearing the deeply-lobed corolla and *gyrate antheral margins* of Cucurbitaceæ, the two stamina recalling Stylideæ. Canarina, of Campanulaceæ, by its ample ochraceous corolla, its succulent, venous vine, and cucurbitaceous tendrils, gives alone sufficient evidence of this connection, conceived by Oken likewise.

Through Nhandirobeæ, Papayaceæ, and Cucurbitaceæ, in nuciferous Gronovia we arrive at a resolution of the epigynous *peponiferous forms*, perigynously continued in Passifloreæ.

Of all the epigynous passages, the one just considered is no doubt the most extensive in species, groups, and relations. Its synantherous, cupulate, achenia-bearing forms are the counterpart forms of the likewise aggregate-flowered Cupuliferæ and Ficoideæ; the former, with the nut, the acorn, chinquapin, etc., one huge, epigynous, pergameneous achenium, and nutted, sometimes oily seed, in a xanthoid involucre. The campanulaceous type reproduces Valerianeæ to a certain degree, and Cucurbitaceæ the *quasi*-meloniferous fruit and habit of Eupomatia, Serpentariæ, and Begoniaceæ; and in habit and texture, and in the costate fruit and scabrous feel, the climbing Loasaceæ; while Passifloreæ in their foliage repeat the violaceo-vitidoid type, and in Passiflora lutea the foliage of the ivy.

Whatever be the mediating links, Passifloreæ claim a very close affinity to Columniferæ. In the biserially lobed "perigon" of Homalineæ, as well as in the multiserially fimbrate one of Passifloreæ, consisting of transitional forms between petals and stamens, Calycanthus, and in the staminal tube enclosing the pedicle of the capsule, the gynandrism of Aristolochia is reflected. There is evidently a very many-sided and accumulated relation of habit between the cucurbitaceo-passiflorous and the calycanth-eupomatio-serpentarious passages of the immediate, running file of connections observable, and as striking as the coincidence of somatic type between Cacteæ and cactoid Euphorbias.

The perigonal habit of Samydeæ seems to vindicate for it a place close to Homalineæ, while the pulpy indument of seed, as in Bixaceæ likewise, recalls the same feature in Momordica. Malesherbia perhaps belongs near Gronovia and Passifloreæ.

In podded, hypogynous Bixaceæ we have an evident affinity to the eleutheromerous tribes of Columniferæ, such as Tiliaceæ and Sterculiaceæ. In fact, the difference of the latter consists mainly in its plurality of carpic follicles, which is no distinctive character at all. It is in Sterculiaceæ, offering numerous partial resemblances to Passifloreæ in the structure of the calycine lobes and submonadelphous stamination, that among the various embryonal types the malvaceous one is introduced.

Malvaceæ, Byttneriaceæ and Tiliaceæ are noted as constituent parts of the Class Columniferæ. In both Byttneriaceæ and Tiliaceæ we find, on the one hand, amygdalinous embryons destitute of an albuminous aura; on the other, a presence of albumen,—showing the subordinate value of this criterion.

In Columniferæ we find all the carpic forms of Rhœades and Ranunculaceæ represented—Aquilegia in the spirally twisted follicles of Helicteres, Papaver in Sida and the like, Biscutella in Heliocarpus, a siliqua in Corchorus, a drupe in Grewia and others, a sapindoid winged fruit in Columbia.

Closely allied among themselves are Ternstœmiaceæ and Chlænaceæ, while of the former Trochostigma in its carpic structure strongly recalls Phytolacca. Gyrostemon, a phytolaccaceous plant, on the trunk of Phytolacca bears a turbinate fruit of inverse *acerine-winged* carpels, with a semilunar seed, and compactly radiating from a *peltate central columella* as of Lavatera. Phytolaccaceæ are justly considered proximates to Malvaceæ. The carpic segmentation of Phytolacca is also obvious in Coriaria, apparently closely allied to Tremandra, and by the scarious floral induments, the ligneous segmented capsules, and coriaceous foliage, Erythroxylon likewise claims the vicinity of théine Ternstrœmiaceæ and purple-juiced Phytolacca. Clusiaceæ, perhaps, likewise belong to this neighborhood, of which the epigynous phase seems to be represented in Rhizophoreæ, their epigynous structure being mediated through such nucamentaceous forms with an enveloping persistent, indurated calyx, as Dipterocarpeæ, Soulameæ, Trigoniaceæ, the former of acknowledged columniferous affinity. To the immediate neighborhood of Rhizophora, with large embryonal radicle protruding through an apical pore of the nut, belongs, by the same character, Trapa, and by the comparatively huge radicle, almost filling the whole seed, Rhizoboleæ, with mostly four to six nuts, cohering at the central angle (Endl.) in the fashion of Columniferæ.

The affinities of Rhizophoreæ, an epigynous form, is manifold, confirmatory of the suggested rule. Its affinities refer it, more distantly, to Myrtaceæ and Loasaceæ. The nucamentaceous calycine form of Dipterocarpeæ repeats the carpic type of Gronovia at the onward dissolution of the cucurbitaceous type, and between them obtains the *columniferous* circuit type or cycle, by its polymerism and large flowers chiefly repeating the habit of Magnolioids (Magnolia, Adansonia).

The *samaroid* type is already initiated in many columniferous forms, with a foliaceous plicate, curved embryo in a monospermous samaroideo-appendaged carpic element, as in Gyrostemon likewise.

The calycine peculiarity of Dipterocarpus and Lophira, two of the five calycine segments being alately increased, is that of Polygaleæ likewise, of which, in Securidæa, in the solitary acerine or malpighiaceous samara, we see the affinity confirmed; while some prickly, rugose, carpic forms point out an affinity to Æsculus and certain Evonymus species, and Krameria seems the very intermediate form between nucamentaceous Dipterocarpus, Trigonia, etc., and Hippocastaneæ.

These forms, with amplified calyx, pelargonoid petals, and huge conferruminated cotyledons, as in Tropæolum, no doubt present an affinity in habit to Gruinales, placed in this vicinity by Endlicher, while by total connections they claim a position intermediate between Umbelliferæ and Rhœades, Endl. Indeed, the true location of Vochysiaceæ and Melianthus, whether intrinsically of gruinal or sapindoid affinity, remains yet to be investigated, while by habit they belong to both. These three coincidences of the serpentarioid type and the peponiferous, the gruinal and sapindoid, the cactoid and euphorbious, were the base for my attempt at a graphical representation of these coincidences, by geometrically projective identification, or, in a plane, an intersection of these corresponding points,—of one and the same continuous *line* representative of ***serial*** connection, which by no means excludes a ***multiplicity*** of relations, nay, of immediate total affinities, so frequently alleged by authors, and embodied in their various serializations, by no means contradictory of each other, nor of the idea of serial continuity generally speaking, ***provided the divergent lines circumscribe a figure*** (***return***).

The connection between Æsculinæ, Sapindaceæ, Malpighiaceæ and Acerinæ requires but to be mentioned to be striking to the contemplator, chiefly of the various tricoccous, pterococcous, samaroid, alate and inflated forms of Sapindaceæ, in the large-seeded version continued by Æsculinæ, in the winged by the sejunct acerine samaræ of Malpighiaceæ. Staphylea is by habit of a fraxinous, by flower, of a perigynously acerine (Ac. platanoides), by fruit, of a cardiospermous affinity. Negundo is an apetalous Acer, Fraxinus a simplified Negundo fraxinifolia. The petaliferous forms of Fraxineæ, as Chionanthus, exhibit a purely hypogynous phase. To this conjuncture, no doubt, Empetræ, Putranjiveæ, Nitrariæ and Celtis may be referred, the proximals of the latter again being of manifest acerine affinity, such as Ulmus, while Ptelea seems to be a compound of chionanthous flower, ulmous fruit, and fraxineous foliage; perhaps, however, by its subtherebinthinous property and other characters accountable of rutaceo-xanthoxylous affinity.

Apetalism abounds in Malpighiaceæ, Acerinæ, and Fraxineæ, and a correct clue as to what other depauperated forms represent is certainly difficult. If, with most authors, we assume for perigynous Ulmaceæ an affinity to epigynous Cupuliferæ, we have once more arrived at an epigynous, nuciferous, cupulate, caryopse form, resembling, in these points, Synanthereæ. Datisca, apetalous and of cannabine habit, has much of a sapindaceous character, also the open carpels of Reseda, of an essentially *gruinal* connection and therefore no less influential in vindicating to Datisca a sapindaceous neighborhood.

It can not be denied that, in florition, the female flower of Datisca has exactly the appearance of that of Juglans, afterwards alienated by a different development of seed; Juglans itself, however, has an ossified *epigynous achenium* for a fruit, included in a cortical cupule.

If we assume the coreopsoid achenium of Betula for the epigynous form of perigynous Ulmus, their habitual juxtaposition seems justified. Juglandeæ connect, by Pterocarya, with Corylus, and the latter, through Myrica, whose fruit is an indurated, *epigynous!* micro-coryline and micro-glandous one, with Cupuliferæ, which, through Carpinus, join *Cannabinæ!* through Humulus. The affinity between Carya and Pistacia seems to have determined Endlicher to bring Juglandeæ in contact with Anacardiaceæ, violently separating the former from their natural location with other Amentaceæ. Perhaps part or the whole of Anacardiaceæ require to be referred to the acerino-amentoid vicinity, their epigynous form then being represented by Juglandeæ.

Cannabinæ bring us into close proximity with Urticeæ, which, however, are hypogynous. Thelygonum is referred by Endl. close to Cannabinæ. As far as I could detect, the staminal flowers have a tubular, in full florition macerated, perigon, and the parts described as a perigon in Endl. Ord. are real bracts.

Judging from the thelygonous habit and cannabine male flowers, in an interrupted terminal spike, Halorageæ belong likewise to the immediate neighborhood of Casuarina, a *moriferous*, though scarious-leaved, apparently hippurine, tree. The female flower closely resembles that of Broussonetia, its staminal ones those of Salicornia. If we strip the fruit of Myriophyllum of its delicate calycine indument, we have the peculiarly four-edged fruit of Callitriche, consisting of four crescent-shaped segments. Considering the frequent indications of moriferous, platanoid, and casuarinous type (Blitum, Obione, Salicornia), I should think that the whole of Oleraceæ, considered in the vicinity of Dianthoids, rather refers here than elsewhere. In Nyctagineæ we have the rigid tubular calyx of Liquidambar, in whose neighborhood perhaps Datisca, with its open carpels, likewise might be referable. In Platanus we have the orbiculate, leaf-like stipulæ of Polygonum orientale and Salix species; in Liquidambar, a valvate, polyspermous capsule. With Plataneæ Artocarpeæ most closely connect, which are known to merge into Moreæ, Urticeæ, and Ficinæ; and the latter, by total and especial resemblance, often mentioned by authors, merge into the fleshy cupuliferous forms of Euphorbiaceæ, presenting, by their *cactoid, involucrate* forms, a striking *somatic resemblance* to the Cactus Order, and withal multifarious in its affinities like other epigynous forms, e. g., with Asclepiadeæ by the milky juice and satin bast of Euph. corollata, while Cyathophora pandurata plays in abundant variations of *amentoid* foliage, from the sinuate-pandurate leaf of Q. coccinea, or Q. nigra (Black Jack), to the linear, lanceolate, serrulate one of Salices, by way of repetition. Perhaps, in a certain sense, Artocarpeæ and Ficoids generally, by their *floral integuments maturing*, may be claimed as vicariating for epigynous forms, but of an *aggregated, depauperated, and apetalous* condition, the other conjunctions being mostly epigynous.

The one-seeded and no longer *cupulate* forms of Euphorbiaceæ, such as Crotonopsis, have much resemblance to Santalaceæ, which might be considered their truly epigynous version, connected with apetalous, petaloideo-calycine, Proteaceæ, Aquilarinæ, blistering Daphnoideæ, Eleagneæ, by such forms as Hippophaë rhamnoides strongly suggestive of rhamnoid affinity, which is fully tenable on the evidence of such *apetalous* Rhamneæ as *Phylica*, which might be almost as well accounted an Eleagnoid.

Rhamneæ, Celastrinæ, and Hamamelis, of rhamnoid foliage, evonymoid flower and capsule, and a xanthoxylous seed, present many features in common with the rutaceous Orders. The persistent calyx of Hamamelis is indicative of an impending epigynous form, perhaps the epigynous genera of Anacardiaceæ. The floral structure of Celastrus and Rhus are much alike. Perhaps the hypogynous genera of Anarcardiaceæ belong this side of this epigynous climax, between itself and Santalaceæ and the epigynous forms of Proteaceæ comprising the *thymelaceous type.*

The close affinity of Anacardiaceæ, Rutaceæ, Diosmeæ (Zygophylleæ?) and Xanthoxyleæ is well known. The latter are initiatory of the hesperid Orders, such as Meliaceæ, Cedrelaceæ, Auriantiaceæ, by Connaraceæ, Simarubeæ and Ochnaceæ connecting with Leguminosæ.

In Cæsalpinieæ the eleutheromerous habit of Cassia is suddenly transformed into a highly symmerous and perigynous, *fuchsoid* one in Gymnocladus, and reduced in Mimoseæ, still more in Papilionaceæ, until an increased calyx, with a *tubiflorous coalescence of petals*, is arrived at in Trifolium.

From Anacardiaceæ to Cæsalpinieæ, however, no perfect epignyism, apparently, is known, although closely approached by Gymnocladus, of ribesioid floral structure and aroma. Between it and Trifolieæ, etc., true Leguminosæ seem to be contained, while through Chrysobalaneæ, Amygdaleæ (Prunus virginiana, Spiræa Aruncus), Rosaceæ (Rosa, Cratægus), and Pomaceæ, the termination of Dicotyledoneæ is arrived at, all being subsumed; and for Pomeæ no other true affinity, not even to Myrtaceæ, otherwise contained, is recognizable, except in one sense: backward, toward Rosaceæ.

The serialization of Dicotyledons completed, doubtless the most difficult and extensive part of the subject was discussed.

I was struck with the uniformity of type between these three successive types or floral circuits: the nymphacaceo-magnolioid, the violaceo-cissoid, and the geranio-rhœadoid. In the two at either extremity the aconite peculiarity of floral structure is recurrent, in Aconitum, Tropæolum, Impatiens (fulva), Corydalis. Ranunculaceæ, Violaceæ and Geraniaceæ (Anemone, Geranium, Ran. abortivus, Viola delphinifolia) have much similarity in foliage; and where they become pinnate, as in Thalictrum, Aquilegia, Umbelliferæ, Fumariaceæ, Loasaceæ, the same trinary type of division obtains. The coincidences of foliar habit are too frequent to need further exemplification; but it must be striking, how completely, suddenly and pervadingly their *papaverous* habit is changed in the contiguous hypericino-dianthoid, crassulaceo-saxifragous and salicario-myrtaceous circuits, forming a triad likewise of homogeneous foliar habit and "*corniculate*" or cerastoid capsular structure and small rigid foliage.

If, suggestively, for the next three circuits we look for a common character, we find in Tubifloræ, Synanthereæ and Columniferæ the *coalescence of corollar and staminal parts*, causing in Malvaceæ the flower to be shed as a connected whole no less than in Tubifloræ, and also a tendency at *connectival* enlargement, throughout, in Tubifloreæ, Synanthereæ, Peponiferæ and Columniferæ, producing a striking resemblance between *reniform* malvaceous and Labiatæ anthers, and, in the gyrately coalesced antheral seams between certain Sterculiaceæ and Cucurbitaceæ + Columellias; we likewise find a tendency for the occasional recurrence of large placentas and capsular follicles, as in Bignoniaceæ, Asclepiadeæ, Cinchoneæ, Cucurbitaceæ, Bixaceæ, Sterculiaceæ and Byttneriaceæ. The increase of the connective produces in Asclepiadeæ a resemblance to Violaceæ, their pollen a well known one to Orchideæ.

The æsculo-sapendoid, amentaceo-oleraceous and thymelaceo-rhamnoid triad of floral circuits can be said to be characterized by the prevailing monospermous follicles and *amentoid apetalism*—"Apetelæ," *par excellence*.

The citroid, legumiferous and rosiflorous triad, if a triad, and not a single circuit, might be qualified as the truly pinnate, legumiferous or *amygdalinous-seeded* one, none of these characters, however, being constant.

The natural subdivision in apparently fifteen intra-epigynal floral courses or circuits, and their natural subdivision into five triads once conceived, I tried to express geometrically the coincidences of type above detailed. The suggestion, that it might be graphically realizable by a sort of phyllotactic $\frac{2}{5}$ divergence, the parts in question being 5, a number *organically realized* in phyllotaxis and organotaxis generally, and a sort of recurrence or *alternation* (p. 53) of types being conceived: on the mere adjustment of the peponiferous node to the serpentarious, and, next, the geranioid to the accrine, the euphorboid became at once coincident with the cactoid, the ribesioid with the gymnocladous, the tubiflorously capitate type of Scabiosa with the likewise tubiflorously capitate one of papilionaceous Trifolium. If these coincidences be so adjusted as to make the respective *epigynous phases* coincide, then the pentagrammatic figure at once exhibits the nodal phases by intersections and corners; as a geometrical representation of the 15 assumed circuits, their triadic subdivision into 5 large types, and their order of succession. If we would realize each type as a *circuit*, and the mutual epigynous relations as a mutual *coincidence in space*—if we draw the five points of intersection together in one central point, then the hypotenuses to the rays are converted into circles (or omegas, so to say, if kept sufficiently apart to indicate the *order of immediate connections*), which gives a twenty-fold affinity to each intersection-node; and if the points of the rays be likewise hauled in and united with the central point, the 15 circles connect there in the shape of a turban, and there are 30 diverging directions of typic development from one *quasi*-centre, or 28 distal affinities, and 2 essential and real ones, to each epigynous point.

In the *radiate* ("Anatole") and the inversed *cyclar* ("Synarmosis") figures, the *convergent sides* have a remarkable correspondence of type, such as between polymerous Columniferæ and Magnoliaceæ, tricoccous or bladdered, ternate-foliaged Sapindaceæ and Geranio-Rhœadoids, geniculate curvembryonous Oleraceæ and Dianthoideæ, resinoso-punctate Myrtaceæ and Citroids, peach-bloom, drupaceous Tubifloræ and Rosaceæ, and at every approximation of a point of intersection, four different types are approximated, such as the rosaceous, tubiflorous, aggregate and leguminous in Spiræa, Hydrangea and Valeriana; Scabiosa, Trifolium, Lonicera; Sanguisorba, Trifolium (and Mimosa!), Scabiosa, etc.; while others, such as between Rosifloræ and Myrtifloræ, are satisfied by the representation in a central connection. In the astral configuration ("Anatole") the hypotenuses (and in the inverted, cyclar one, where each triad is represented as a circle, divided by intersections, the exterior arches) are remarkable for their *duplicity* of type, *corresponding to the contiguous sides:* as Leguminosæ assume the apetalous myrtoid habit of Metrosideros in Mimoseæ, the labiate or ringent floral type in Papilionaceæ; Aggregatæ assume the spiræoid type in Valerianeæ, the sanguisorboid in Scabioseæ, the ranunculoid in (apparently *polymerous*) Synanthereæ; Violaceæ and Ampelideæ the sterculiaceo-tiliaceous, digitate-palmate leaved, Araliaceæ and Umbelliferæ the pinnate spray of Sapindaceæ; Cupuliferæ the pandurate, lyrate foliage of Papavero-Cruciferæ, Oleraceæ the dianthoid one, Saxifrageæ the punctate one.

Cryptogamæ naturally divide into five natural groups, *very distinct in habit*, yet connected: Fungi connecting with Lichens by epidermal (dots and clouds on the epidermis of apples, etc.!) Actidieæ and Graphidinæ; Lichens by otherwise umbilicarioid Collema with Nostoc and Zonarieæ of Algæ; the latter with mosses by the foliate articulated forms, as Cladostephus, Batrachospermum and (epigynous!) Chara with Chlorococcum, the acaulous capsule of Lepraria kermesia or Proto-Chlamydococcus, joining Archidium and Sphagneæ; and mosses with ferns thro' Lycopodiaceæ and Equisetaceæ. The bisexual-spored natant ferns initiate the *amorphous*, *phyllodial* phanerogamous forms of Lemna, Balanaphoreæ (Rafflesia?) and Cycadeæ, joining Cupressinæ and Coniferæ generally by their truly monocotyledonous seed (Vol. I, Phyllotaxis, p. 48) and phyllodial scales, through Gnetaceæ joining Ruscus.

By the conjunction of Coniferæ to Monocotyledoneæ, in the literal significance of the term, we have five rather natural divisions in Monocotyledonæ likewise—Coniferæ, Iulocauleæ, Liria, Gramineæ, and Spadifloræ; the convallario-melanthoid forms, however, not so typically distinct from Liria as all the rest are among themselves and these.

That the quinary astral figure applies equally well to Cryptogamæ and Monocotyledoneæ as to Dicotyledoneæ, although by no means infallibly, but only in an average sense, may be realized by the schematic representation, which however claims no other significance than that of the ideas by which itself was *arrived at.*

It would not appear likely that a graphic representation, in which proximity in space would signify correlation, is at all the most serviceable; for, in all other organic combinations and repetitions, as the bodies of the organisms themselves are, the organs of equal function or value are *not* coincident or catervated, but only *architectonically correspondent:* and thus it may, after all, turn out to be an organically architectonic form, which might best serve to spatially embody the correlations of vegetable types.

Leaving the detailed discussion of Cryptogamæ and Monocotyledons, and the characterizations of their component groups, for future communications, I would here add some explanatory remarks on the accompanying Plate.

The body of Fungi is the *incorporated sarcodic*, filmy, thalline mould. Mushrooms and puff-balls, as well as superficial mould, are merely its *fructifications*. As that of ferments, I consider the *floating scum* of free spores—*Vappa*. Cheese, likewise, is the organo-chemic result of a fermentative mucor, the developments of which are indicated by the stratifications of cheese. In putrid diffluence the sporous development appears as a rusty, supra-natant *Vappa;* in dry ones, as a favoid crust.

In lichens, the *dry*, *pastous*, *gay-colored* tissue is entirely drawn to the surface as a *membrane*, and develops its perfect form and fructification only in *bright light;* while Fungi, its next allies, require the dark and a cosubstantiation with the soil. The exuberant, mealy, cytic luxuriations of lichens, found on shady rocks, in crevices, etc., and called mountain-meal, are well known. I have found one individual of Parmelia aurantiacca on one half degenerated into Byssus aurea; a *cytic luxuriation* of Parmelia, not a Hyphomyces. (Endl.) "Lecidea" humosa I find, in a perfect specimen I possess, to be a Collema, with a sporangial Solorina scrobicle! In Collema, the aqueous, algoid type of a sudden commences, connecting with Zonarieæ, Peyssonnelia (Phyllophoreæ), etc.

In a full-grown Conferva, of five feet length, I found *numerous large sporangia*, of the size of a common moss-sporangium, in solid continuation with the capillary stem. Its bivalvously dehiscent, *cytidophycoid* sporangium resembles the bran or scab of canary-seed; and its bright green, clavate contents resemble a bright-green *calculus*, and coalesce, when emitted, into larger calculi. No doubt the component cells of Baccillaria are mere vegetal or thalline phases of cytic development, and their true fruit yet to be observed, as in Conferva they seem to have been taken for impurities, and cleared away before microscopic examination. Then the "*fila substantia opaca grumosa facta*," the dark granulated films, seem, as in other algæ, to represent the paraphyses, and the "copulation of cells" a sort of *budding*. In Bryopsis I found branches with spikes of filiform, acuminate *leaves*, and *large spores* (*sporangia?*), besides their known phyllodially hypnoid, ramified branches, with grumously granulated (male) terminal cells.

The vesicles of Chlorococcum I followed in their further development. They arise in dense crowds on desultory crystalline cells, no doubt their humous *thallus*. After emitting their spores by an *apical* pore, like mosses, the contents, by development, change into a confervoid velvet. This develops into varicosities, assuming a *miniate* color, as "Lepraria kermesina," covering, at certain seasons, all open ground in a region, by millions of acres probably. The miniate varicosities by cytic pullulation develop into a loose, brownish sand-colored luxuriation of cells resembling ashes and loose humose earth, so light as to be swept away by every wind. As this plant goes through so many developments, besides its perfect, sporangial one of Chlorococcum, is it not possible that the various cytic developments or conceived "changes of generation" of the Proto-Chlamydococcus cells are mere thalline developments, (as in lichens and probably Baccillaria likewise,) and that perhaps they merely are the conditional developments of the Chlorococcum cells strewn throughout the atmosphere? Sphagnum seems to derive its nourishment solely from the atmosphere, adding to, and substracting nothing from, the soil. It contains large, open cells of air in its dew-drenched foliage, and increases on a rootless stem. Ferns require a soaked soil, and a warm, steamy atmosphere—a fusion of elements, as it were.

In these five typically different qualities of tissue-development in Cryptogamæ, a parallelism with the gradual development of the *seed* can be conceived, and themselves as so many *exposés* of somatogenetic processes in general.

GRAPE CULTURE IN MISSOURI.

BY G. C. SWALLOW.

There is, perhaps, no department of husbandry in which cultivators find so much difficulty and meet with so many failures as in the cultivation of the vine; and yet, while some fail, it is equally true that others meet with eminent success. It is quite obvious that the most of those who have failed in their efforts must attribute their failures to the want of adaptation, in their modes of culture, to the habits and wants of the vine; as others, on the same soil and under the same sun, have been most successful.

Notwithstanding the true principles of grape culture are so little understood by the community at large, no department of agriculture has been more carefully investigated, more distinctly defined and reduced to scientific principles. Since Virgil wrote his masterly treatise upon the habits and cultivation of the vine, the principles which should govern its culture have been within the reach of all who would investigate the structure of this plant, and learn the soil and climate adapted to its perfect development. And, indeed, it could scarcely be otherwise, as the vine has occupied so prominent a position in the husbandry of almost all the enlightened nations of ancient and modern times. Since Noah planted a vineyard, the vine has followed the progress of husbandry and civilization throughout India, Arabia, Palestine, and Southern Europe. It holds an important place in the history of those seats of ancient civilization and progress. The "vine-clad hill" occupied a conspicuous position in every landscape, and the juice of the grape had its place at the social board and ruled the joys of the banquet hall. While it held so important a position among the nations, its value led the ablest minds to investigate its habits and deduce the best modes of culture from the experience of the many engaged in the pleasant pursuit. Solomon investigated the properties of the vine, and Virgil gave so excellent a treatise upon its habits and culture that the investigations and experience of the last two thousand years have added but little to the knowledge then possessed. Since then the habits of the vine, and the modes of culture best adapted to it, have been so carefully determined, and so thoroughly established by the experience of the last 4,000 years, it only remains for the cultivators of our times to investigate the modes of culture so long and so successfully practiced in India and the countries bordering upon the Mediterranean; to inquire how far the varieties then cultivated, and the culture then adopted, will succeed in other localities; to determine whether some new varities may not succeed better in other climates and soils; and what modifications of culture will secure the highest degree of success in the various soils and climates to which we would introduce the vine.

It is obvious that the success of the grape depends upon the mutual adaptation of both soil and climate. In places where the soil has all the requisite properties, the climate may be such as to prevent full success; as in many parts of New England, where the climate is too cold, and in England where it is too moist. In many localities in Southern Europe the soil is such as to prevent the full success of the vine, though the climate is all that could be desired.

Soil.—According to Virgil* and the best authors who have followed him, the soil should be *warm*, *light*, *dry*, *and rich in alkalies* and *alkaline earths*—especially *potash*, *soda*, *lime* and *magnesia*. The best vines have been grown† upon soils of

* Geor. Lib. II., lines 217-221 and 262—"*Optima putri arva solo.*"

† The great vine at Windsor Park was planted about fifty years ago. "In 1850," says Prof. Lindley, it produced 2,000 large bunches of magnificent grapes, filled a house 138 feet long and 16 feet wide, and had a stem 2 feet 9 inches in circumference. The border in which it grows is *warm*, *light*, *dry* and *shallow*."

this description, and when any of these qualities have been wanting the most skillful vine-growers have carefully supplied them by artificial means. Hence Virgil directs to place "porous stones and rough shells" in the trenches—the stones and shells to loosen the soil and perfect the drainage, and the shells to supply the defect of lime. The vine has ever succeeded the best, other things being equal, in a calcareous soil. The best vineyards upon the Rhine, the Ohio, and the Missouri are upon soils rich in lime; and according to D'Orbigny, the wines from such' in France are more lively and spirituous.

The chemical composition of a plant also gives us sure indications of the mineral ingredients of the soil required for its perfect development. The following Table, from Johnston's Agricultural Chemistry, contains the compositions of five vines grown on five different soils. The result shows most conclusively what mineral substances are demanded for the perfection of the vine.

	By Leibfrauen.	By Weinsheimer.	Primary Rocks, Gratz.	Mountain Limestone. Gratz.	Mica Slate.	Mean.
Potash	17.32	25.24	34.13	24.93	26.41	25.60
Soda	28.50	2.74	8.03	7.31	8.79	11.07
Lime	29.75	40.75	32.67	37.59	33.47	34.85
Magnesia	9.78	7.47	4.66	7.12	9.16	7.64
Oxide of iron	4.12	1.52	0.16	0.24	0.19	1.25
Phosphoric acid	5.20	18.87	16.35	19.55	16.87	15.37
Sulphuric acid	1.96	2.88	2.16	2.37	2.44	2.36
Chlorine	1.82	0.53	0.50	0.35	0.25	0.68
Silica	1.55		1.45	0.62	2.48	1.22
Total	100.	100.	100.11	100.08	100.06	100.04
Per centage of ashes in dry twigs	2.885	2.689	2.525	2.25	2.325	2.525

These analyses show that Potash, Soda, Lime, Magnesia, and Phosphoric Acid enter largely into the composition of the vine, and that grapes will succeed best on soils rich in those materials. The other ingredients are such as are found in nearly all soils and may be left out of our investigations.

It is a well established principle of vegetable science that *lime* may supply the place of *soda* and *potash*, in part at least, in some plants. The following analyses of vines from two localities show this to be true of the vine also:

	I.	II.
Alkalies	45.82	27.98
Lime	29.75	40.75

If therefore soda and potash be deficient in soil, their place may be partially supplied by lime, should it exist in sufficient quantities.

Climate.—The success of the grape on the islands and the shores of the Mediterranean show their adaptation to a climate in which the winters are short and mild, and the summers are temperate and equable. In the Ionian Islands, where the grape attains great perfection, it is never exposed to pinching cold or burning heat, or to any very sudden changes from one to the other. But the great profusion and excellence of the grapes in India, at Candahar and Cabul, the sunny home of the grape, indicate an ability to reach perfection in spite of sudden changes from extreme cold to burning heat. "In no part of the world," says Lindley, "are the grapes more delicious than in Candahar and Cabul"; and yet the traveller speaks of the *bitter cold wind* and *blazing fires at night*, and the *burning sun* by day, in March; and the sun's heat at 140° in May, where the grapes ripen as early as June.

We may conclude then that the grape will, under favorable circumstances, reach the greatest perfection though exposed to sudden changes and extremes of heat and cold.

Having ascertained the conditions of soil and climate best adapted to the successful culture of the vine, it has been my aim, during the progress of the Geological survey of Missouri, to determine how far these conditions are fulfilled in Missouri; to what extent and with what success the vine may be cultivated in our State, and the advantages to be derived from its cultivation. In order to secure the most accurate data for our conclusions, our investigations have been directed to the following subjects:

1. The characters and habits of all our native vines, and the soils on which they succeed best, have been carefully noted.

2. Five persons* have been been appointed to make meteorological observations. One at Springfield in the South-West, one at Cape Girardeau in the South-East, one at Palmyra in the North-East, one at St. Joseph in the North-West, and one at Columbia in the Center, in the valley of the Missouri River. These observers have been supplied with the very best instruments, and they have made and recorded

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* It gives me great pleasure to bear testimony to the disinterested labors of those who have so faithfully observed and recorded the meterological phenomena at the stations above named. Our State will be under many obligations to the Rev. G. P. Comings, of St. Paul's College, Palmyra; Rev. James Knoud, of St. Vincent's College, Cape Girardeau; J. A. Stephens, Esq., Springfield; E. B. Neely, A.M., of the St. Joseph High School; and Miss M. B. Hill, at Columbia,—who have made the observations at their several localities.

their observations according to the plan adopted by the Smithsonian Institution.

3. The experience of our most successful vine-growers has been collected, and the results carefully compared with the conclusions derived from our examinations of the climate, soils and wild vines of the State.

4. The soils of the State have been carefully observed, and the varieties collected and submitted to a most skillful chemist for full and accurate analyses.

Native Grapes.—The growth and fruit of our native vines give us most important indications of the adaptation of our soil and climate to the cultivation of the grape. The following species have been observed; the growth habits and fruit of each variety have been carefully examined.

1. VITIS LABRUSCA, *Linn.* *Fox Grape* of the Northern States.

This vine is abundant in all parts of the State. It attains to a very large size* in our rich alluvial bottoms and on our best upland soils; but the vines of a smaller size, which are found on the poorest soils in the State, produce much the best grapes. Those which grow upon the dry ridges, on the declivities of the bluffs (especially those of the Magnesian Limestone) and on the talus of debris at their bases, exhibit a healthy, firm growth and produce an abundace of fine fruit. The grapes found in these localities are larger, and the pulp is more juicy and palatable.

Many well known and excellent varieties of grapes now in cultivation were derived from this species. The *Isabella*, *Catawba*, *Schuylkill*, and *Blands*, are the most esteemed.

2. VITIS ÆSTIVALIS, *Michx.* *Summer Grape.*

This, like the preceding, is found in all parts of the State, and is doubtless the largest of all our vines. It is one of the most striking objects in our magnificent forests, while the stem, like a huge cable, hangs suspended from the limbs of the largest trees, the branches clothed in rich foliage, and often loaded with fruit, hung in graceful festoons over the highest boughs. But the vines growing on the thin soils of our limestone ridges and bluffs, and on the loose debris at their bases, where they are more exposed to the air and the sun, produce a greater abundance of the best fruit.

3. VITIS CORDIFOLIA, *Michx.* *Winter* or *Frost Grape.*

This vine is widely diffused through the State; but it is

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* This vine often attains a diameter of 10 inches, ascends the loftiest trees, and spreads its branches over their highest boughs.

not so large as the Fox, or the Summer Grape. Its fruit is small and acerb.

4. (*Var. of the former, gray.*) VITIS RIPARIA, *Michx.* *River Grape.*

This grape is partial to the alluvial soil along the margins of our streams. It grows to a large size.

5. VITIS VULPINA, *Linn.* *Muscadine* of the West, and *Fox Grape*, according to Elliott, in the South-eastern States.

It is most abundant in the southern part of the State. It grows very large and produces abundantly. Its fruit is very much esteemed. The cultivated *Scuppernong Grape* is a variety from this species.

6. VITIS BIPINNATA, *Michx.*

This plant was observed in Cape Girardeau and Pemiscot Counties.

7. VITIS INDIVISA, *Willd.*

This vine abounds in the central and western counties.

From this list it will be seen that Missouri possesses all the native grapes of our country save one, the *Vitis Caribæa?* (D. C.) of California. The vines are so abundant and so large as to form an important and conspicuous part of every copse and thicket throughout the entire State. They are everywhere present, lending grace and beauty to every landscape, and indicating with prophetic certainty that the day is not far distant when the purple vineyards will cover our hills, the song of the vine-dresser fill the land with joy, and the generous juice of the grape will improve our moral, intellectual, and physical powers.

*Experience of our Vine-dressers.**—Several vine-dressers in our State have been engaged in the cultivation of the grape during the last twelve or fourteen years. Their success has been fully equal to their expectations; and they are full of high hopes of the most useful and profitable results, even of entire and *permanent success.* Their experience in cultivating the vine has led them to the same conclusion that we have deduced from our scientific examinations of the soil, climate, and native vines; viz., *that the vine can be cultivated with entire success, in favorable localities, in all parts of the State.*

* I am indebted to Mr. Wm. Haas, of Boonville, Mr. Geo. Husmann, of Hermann, Mr. Frederic Munch, of Marthasville, and Mr. Joseph Stuby, of Hamburg, for valuable information respecting the cultivation of grapes in our State.

It should be borne in mind that these results have been derived mostly from vineyards in the valley of the Missouri and Mississippi Rivers, which are not, by far, the most favorable localities in the State; for the "mildew" and the "rot," the most formidable obstacles they have had to contend with, may be partially or entirely obviated in localities where the atmosphere and soil are not so densely charged with moisture. "The *rot*," says one of our most successful vine-dressers, Mr. Haas, "attacks the berries when the soil is in a wet condition, in July and August." "It is most severe on the low and wet parts of the vineyard." Mr. Husmann says, "the principal cause, all are agreed, is an excess of moisture about the roots, and damp, moist weather." Now the larger part of our vineyards are located upon a *stiff*, *cold*, *clayey subsoil*, which of necessity retains the excess of moisture and produces the injurious results.† This evil may be obviated by thorough draining and preparation of the soil; or, what is better, by selecting some of the millions of acres in the southern part of the State, where the soil is *warmer* and *lighter* and richer in the ingredients most favorable to the vine, and where the subsoil is so porous as to permit a free passage to the excess of moisture.

The *mildew* appears in June; and all agree that it is caused by "*foggy*, *damp*, and *hot weather* accompanied by *mists*, which is much more prevalent in the valleys of our large rivers than on the table lands of the south.

The characters of the two regions under comparison show most conclusively that the excess of moisture in the valleys must be considerable and permanent. These valleys are covered with numerous and extensive lakes and sloughs, and forests of rank growth and vast extent, besides the broad rivers which flow through them; while the table lands are almost destitute of lakes and ponds, and but partially covered by a very sparse and much less vigorous growth of timber. And, besides, they occupy an elevation of several hundred feet above the valleys.

No fears, therefore, need be entertained that these obstacles will prevent the entire success of vine-culture in Missouri, should our atmosphere even continue as moist as at present. But we may expect much improvement in this respect, as it is fully established by past experience, that the settlement of a country and the opening of a soil to cultivation lessen the amount of rain and moisture in the atmosphere.

Notwithstanding the many difficulties our vine-dressers have had to contend with, and notwithstanding some of their vineyards are not, to say the least, in the most favorable localities in the State, their success has been very flattering.

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The vineyards of Boonville have yielded the present season about 6,000 gallons, worth $12,000. Five acres gave a clear profit of $2,000, or $400 per acre. Mr. Haas made 1550 gallons from 3 acres.

The vintage of Hermann was about 100,000 gallons, from less than 200 acres. At $1.00 per gallon, which is less than the value, it will give a profit of at least $400 per acre, or of $80,000 on the 200 acres in cultivation. One small vineyard at Hamburg, Mr. Joseph Stuby's, yielded over 1,000 gallons per acre.

The entire cost of vineyards, preparing the soil, setting and training the vines till they come into bearing, varies from $200 to $300 per acre; annual cost of cultivation after, $50 to $60 per acre; ten per cent. on first cost, $20 to $30 per acre; total expense for each year, $70 to $90 per acre. So that an income of $100 per annum for each acre is sufficient to pay the interest on the first cost and the expense of cultivation.

Judging from the statistics before me, I would suppose all our vineyards have yielded an average of at least 250 gallons per acre since 1849, which, at an average price per gallon of $1.60, would give an annual income of $400, and a yearly profit of $300 per acre. So that the vine-dresser, even in the poorest seasons, can scarcely fail of a handsome profit; while in good years his gains will far surpass those derived from any other department of husbandry. But the profits of our most successful cultivators have been much greater. M. Pœschel, of Hermann, is said to have made over 400 gallons per acre for the last ten years, and an annual profit of more than $500 for each acre.

Such are the favorable results legitimately derived from the experience of our vine-dressers, in their early efforts in a new country, with a soil and climate unknown to the cultivators of the grape. All must admit that they are most satisfactory. Even if our climate does not become more dry, if no more improvements are made in the modes of culture, and if no more favorable localities are obtained, grape culture must increase very rapidly, and become an important element in our agricultural and commercial interests.

Climate.—It will be impossible to give, in the few pages allotted me in this communication, the results of our meteorological observations. It must suffice to state in general terms, that the extremes of heat and cold are not so great as in some of the best grape-growing regions; and that the atmosphere in the southern part of the State is sufficiently dry. The results, in short, present but one very objectionable feature. There are occasional changes of temperature so great and sudden as to prove somewhat injurious to the grape at certain stages of its growth. But it should be observed that these changes are not so marked in the high table lands of the south and west as in the north and in the valleys of the Missouri and the Mississippi, where our vineyards are located; and, even where most objectionable, they are not so great as in India, and other grape-growing districts of the old world.

That portion of Southern Missouri, extending from Newton County in the south-west to Ste. Genevieve in the south-east, usually represented as the eastern extremity of the Ozark Mountains, is in fact a table land varying from 1,000 to 1,500 feet above the ocean. In the west it is sufficiently undulating to be well drained, while in the east it sometimes rises into ridges and knobs of moderate elevation. From this table land the country descends by moderate slopes in every direction. On the northern slope are the head-waters of the Sac, Pomme de Terre, Niangua, and Gasconade, flowing into the Missouri; on the east, the Meramec and the Big, flowing into the Mississippi; on the south, the waters of the St. Francis, the Current, and the White with its tributaries, descending towards Arkansas; and Spring River and Shoal Creek on the western slope.

The valleys of the numerous streams which flow from this table land are at first but little depressed below the general level; but the farther they descend the deeper and wider they become, until they expand into broad alluvial bottoms, bounded by bluffs more or less precipitous. The fountains are numerous, bold, and pure; the streams clear and rapid.

The surface of these table lands is undulating, with no mountains or arid plains, to disturb the equable and agreeable temperature which usually prevails at that elevation under the 37th parallel of north latitude. There are no swamps or overflowed lands from which vapors and noxious exhalations can arise to render the air damp and unhealthy. As these facts plainly indicate, the summers are long, temperate, dry and salubrious,* and the winters short and mild. It possesses the clear, brilliant skies of Italy, and the dry, bracing air of the western prairies.

Soil.—Nearly all the soils of Missouri possess all the ingredients necessary to the complete development of the vine; but some of them are too heavy, wet and cold, unless improved by artificial means. This is true to some extent of those on the bluffs of the Mississippi and Missouri, where nearly all the vineyards of our State are located. These soils are based upon the Bluff formation, where it contains more clay and less lime than in the western counties, which possess our best soils.

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* According to the census report of 1850, this is one of the most healthy regions in the country.

Analyses of Soil from the bluffs of Boone Co., by Dr. Litton.

	No. 12 A.	*No. 12 B.*	*No. 12 C.*
Water expelled by drying at 150° C.	0.4105	0.6558	0.8030
Organic matter & water not expelled at 150° C.	3.0957	2.6049	3.8901
Silica, etc., insoluble in hydrochloric acid	90.1420	90.8063	85.0571
Soluble silica	0.1384	0.1475	0.2187
Alumina	3.0654	2.9343	4.7672
Peroxide of iron	2.0553	2.0590	3.8814
Oxide of manganese	a trace	a trace	a trace
Lime	0.2086	0.1242	0.4722
Magnesia	0.3423	0.2088	0.6581
Potash	0.3368	0.2121	0.3895
Soda	0.1828	0.2925	0.1220
Phosphoric acid	0.0560	0.0346	0.0556
Sulphuric acid	0.0035	0.0508	0.0099
Chlorine	0.0000	0.0000	0.0276
Total	100.0373	100.1311	100.3524

No. 12 A was collected from 2 to 6 inches below the surface; No. 12 B, from 10 to 12; and No. 12 C, from 18 to 20 below the surface, on a high ridge.

This soil is very similar to those upon which the vineyards of Boonville, Hermann, and Hamburg, are located; and it produced an abundance of large and excellent grapes, on small vines of the *Vitis labrusca.* The superior native grapes, growing upon this soil, and the success of the vineyards above named, prove its adaptation to the vine. Its greatest defect is a capacity to hold and retain an excess of water; which must be remedied by trenching and a proper admixture of vegetable matter, sand, pebbles, and broken limestone. This labor, however, may be avoided by selecting some of the millions of acres in Southern and Central Missouri, the soils of which are already prepared, as if by design, to invite the vine-dresser to possess and cultivate them.

Analysis of a Magnesian Limestone Soil from the Southern bluffs of Callaway Co., by Dr. Litton. Soil No. 14.

Water expelled by heating to 150° C.	1.1700
Organic matter and water not driven off at 150° C.	9.6299
Silica, etc., insoluble in hydrochloric acid	54.2600
Soluble silica	0.1689
Alumina	10.8588
Peroxide of iron	2.5186
Manganese	a trace
Lime	8.0720
Magnesia	1.6609
Potassa	1.6378
Soda	0.3442
Carbonic acid	10.1111
Sulphuric acid	0.0605
Phosphoric acid	0.0950
Chlorine	0.0053
Total	100.5880

This soil is all that could be desired for the culture of the grape; it contains an abundance of all the mineral substances which enter into the composition of the vine, as shown above by its analysis. While it is *warm*, *light* and *dry*, it contains large quantities of magnesia and vegetable matter or humus, giving it great capacity for absorbing and retaining a sufficient quantity of moisture, even in the droughts of summer. This is a fair representation of the soils on the Magnesian Limestone ridges and slopes throughout Central and Southern Missouri. These slopes and ridges occupy millions of acres now deemed worthless, which are, in fact, by far the most valuable lands in the State for the cultivation of the grape; especially is this true of those located upon the southern highlands, away from the vapors and sudden changes of our large rivers and their broad valleys.

The Magnesian Limestone Series occupies a large portion of Southern Missouri, and is made up of magnesian limestones, sandstones, and porous chert, which are usually overlaid with thin beds of reddish-brown marly clays. The sand, lime, magnesia, and alumina, derived from the decomposition of these rocks, together with the abundance of vegetable matter and the alkalies derived from the fires which annually overrun this country, combine to form a soil* *light*, *dry*, *warm*, and rich in *potash*, *soda*, *lime*, *magnesia*, and all the other mineral ingredients needed to render it fertile, and suitable in an eminent degree for the culture of the vine. In many places this soil is underlaid with a sufficient quantity of pebbles and fragments of porous chert to constitute a most thorough system of drainage; while in others the fragments of chert are disseminated through the soil in such quantities as to injure it somewhat for ordinary cultivation, but giving precisely the preparation so highly recommended by Virgil and later authors, and the best cultivators of the grape. It is true that the native vines do not grow so large and sappy on this as on the deep, damp soils of the State; but they are nevertheless strong and healthy, and produce finer clusters of larger and better grapes. This improvement was particularly observed in the *Muscadine*, the *Northern Fox*, and the *Summer Grapes*.

This variety of soil also extends over a large portion of the counties on both sides of the Osage, and over the southern part of Boone, Callaway, Montgomery, and Warren, on the north side of the Missouri, occupying in all an area of some 15,000,000 acres. Of these, at least 5,000,000 acres might be selected in the most desirable localities and devoted to vineyards, without encroaching upon the lands most desirable for

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PLATE VIII.

BLUFFS OF MAGNESIAN LIMESTONE ON THE NIANGUA 3 MILES N.W. OF GUNTERS SPRING, SHOWING THE NATURAL TERRACES SO COMMON IN THE BLUFFS OF THAT STREAM

other departments of agriculture. And so far as we can judge from the characteristics of soil and climate and the indications of the native vines, these 5,000,000 acres in the highlands of Southern Missouri present rare inducements to the vine-dresser—such a combination of favorable circumstances as will not fail to attract the attention of those who would engage in this most pleasant and profitable department of husbandry. And so important will be the results, that every effort should be put forth to hasten the time when these 5,000,000* acres shall be covered with flourishing vineyards, giving profitable employment to 2,000,000 people, yielding more than 1,000,000,000 gallons of wine, and an annual profit, at the lowest estimate, of $500,000,000. And what is still more important, the pure nourishing juice of the grape would take the place of the vile, maddening compounds used under the names of wine and brandy; drunkenness would give place to sobriety; and our people, nourished by the grape and its pure wines, would become as robust and hardy as they are now daring and indomitable.

Natural Terraces.—The bluffs of the numerous streams in Southern Missouri, and in the valley of the Osage, usually slope back into knobs and ridges, which are frequently surrounded by numerous natural terraces so regular and uniform that they appear like the work of human hands, as seen in Plate VIII. These terraces are produced by the decomposition of the strata of magnesian limestones which form the bluffs. Their height varies from one to six feet, and the width of the top from two to twelve, according to the angle of the slope and the height of the terrace. Their surfaces are nearly level, and usually covered with a light, warm and rich soil, containing fragments of chert and the decomposing limestone, all wonderfully prepared by nature for the planting of vineyards. These terraces generally surround high, open ridges and knobs, exposed to the free circulation of the dry atmosphere of the region under consideration. We have observed but one objection to their use for vineyards. In some places the soil does not appear sufficiently deep to secure the vine against the effects of droughts. But, as an offset to the want of depth, it always contains large proportions of carbonate of magnesia and humus, which give a great capacity for absorbing and retaining moisture; as these substances possess this capacity to a greater degree than any of the other ingredients of our soils. And besides, the thinnest soils on these terraces

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* France has about 5,000,000 acres in vineyards. They yield about 925,000,000 gallons of wine, besides the 95,000,000 gallons distilled into brandy, and give profitable employment to 2,000,000 of people, mostly women and children.

[illegible] Del. [illegible] Engraver.

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Judging from the statistics before me, I would suppose all our vineyards have yielded an average of at least 250 gallons per acre since 1849, which, at an average price per gallon of $1.60, would give an annual income of $400, and a yearly profit of $300 per acre. So that the vine-dresser, even in the poorest seasons, can scarcely fail of a handsome profit; while in good years his gains will far surpass those derived from any other department of husbandry. But the profits of our most successful cultivators have been much greater. M. Pœschel, of Hermann, is said to have made over 400 gallons per acre for the last ten years, and an annual profit of more than $500 for each acre.

Such are the favorable results legitimately derived from the experience of our vine-dressers, in their early efforts in a new country, with a soil and climate unknown to the cultivators of the grape. All must admit that they are most satisfactory. Even if our climate does not become more dry, if no more improvements are made in the modes of culture, and if no more favorable localities are obtained, grape culture must increase very rapidly, and become an important element in our agricultural and commercial interests.

Climate.—It will be impossible to give, in the few pages allotted me in this communication, the results of our meteorological observations. It must suffice to state in general terms, that the extremes of heat and cold are not so great as in some of the best grape-growing regions; and that the atmosphere in the southern part of the State is sufficiently dry. The results, in short, present but one very objectionable feature. There are occasional changes of temperature so great and sudden as to prove somewhat injurious to the grape at certain stages of its growth. But it should be observed that these changes are not so marked in the high table lands of the south and west as in the north and in the valleys of the Missouri and the Mississippi, where our vineyards are located; and, even where most objectionable, they are not so great as in India, and other grape-growing districts of the old world.

That portion of Southern Missouri, extending from Newton County in the south-west to Ste. Genevieve in the south-east, usually represented as the eastern extremity of the Ozark Mountains, is in fact a table land varying from 1,000 to 1,500 feet above the ocean. In the west it is sufficiently undulating to be well drained, while in the east it sometimes rises into ridges and knobs of moderate elevation. From this table land the country descends by moderate slopes in every direction. On the northern slope are the head-waters of the Sac, Pomme de Terre, Niangua, and Gasconade, flowing into the Missouri; on the east, the Meramec and the Big, flowing into the Mississippi; on the south, the waters of the St. Francis, the Current, and the White with its tributaries, descending towards Arkansas; and Spring River and Shoal Creek on the western slope.

The valleys of the numerous streams which flow from this table land are at first but little depressed below the general level; but the farther they descend the deeper and wider they become, until they expand into broad alluvial bottoms, bounded by bluffs more or less precipitous. The fountains are numerous, bold, and pure; the streams clear and rapid.

The surface of these table lands is undulating, with no mountains or arid plains, to disturb the equable and agreeable temperature which usually prevails at that elevation under the 37th parallel of north latitude. There are no swamps or overflowed lands from which vapors and noxious exhalations can arise to render the air damp and unhealthy. As these facts plainly indicate, the summers are long, temperate, dry and salubrious,* and the winters short and mild. It possesses the clear, brilliant skies of Italy, and the dry, bracing air of the western prairies.

Soil.—Nearly all the soils of Missouri possess all the ingredients necessary to the complete development of the vine; but some of them are too heavy, wet and cold, unless improved by artificial means. This is true to some extent of those on the bluffs of the Mississippi and Missouri, where nearly all the vineyards of our State are located. These soils are based upon the Bluff formation, where it contains more clay and less lime than in the western counties, which possess our best soils.

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* According to the census report of 1850, this is one of the most healthy regions in the country.

Analyses of Soil from the bluffs of Boone Co., by Dr. Litton.

	No. 12 A.	No. 12 B.	No. 12 C.
Water expelled by drying at 150° C.	0.4105	0.6558	0.8080
Organic matter & water not expelled at 150° C.	8.0957	2.6049	8.8901
Silica, etc., insoluble in hydrochloric acid	90.1420	90.8068	85.0571
Soluble silica	0.1884	0.1475	0.2187
Alumina	8.0654	2.9843	4.7672
Peroxide of iron	2.0558	2.0590	8.8814
Oxide of manganese	a trace	a trace	a trace
Lime	0.2086	0.1242	0.4722
Magnesia	0.8428	0.2088	0.6581
Potash	0.8368	0.2121	0.8895
Soda	0.1828	0.2925	0.1220
Phosphoric acid	0.0560	0.0846	0.0556
Sulphuric acid	0.0035	0.0508	0.0099
Chlorine	0.0000	0.0000	0.0276
Total	100.0878	100.1811	100.8524

No. 12 A was collected from 2 to 6 inches below the surface; No. 12 B, from 10 to 12; and No. 12 C, from 18 to 20 below the surface, on a high ridge.

This soil is very similar to those upon which the vineyards of Boonville, Hermann, and Hamburg, are located; and it produced an abundance of large and excellent grapes, on small vines of the *Vitis labrusca*. The superior native grapes, growing upon this soil, and the success of the vineyards above named, prove its adaptation to the vine. Its greatest defect is a capacity to hold and retain an excess of water; which must be remedied by trenching and a proper admixture of vegetable matter, sand, pebbles, and broken limestone. This labor, however, may be avoided by selecting some of the millions of acres in Southern and Central Missouri, the soils of which are already prepared, as if by design, to invite the vine-dresser to possess and cultivate them.

Analysis of a Magnesian Limestone Soil from the Southern bluffs of Callaway Co., by Dr. Litton. Soil No. 14.

Water expelled by heating to 150° C.	1.1700
Organic matter and water not driven off at 150° C.	9.6299
Silica, etc., insoluble in hydrochloric acid	54.2600
Soluble silica	0.1689
Alumina	10.8588
Peroxide of iron	2.5186
Manganese	a trace
Lime	8.0720
Magnesia	1.6609
Potassa	1.6878
Soda	0.8442
Carbonic acid	10.1111
Sulphuric acid	0.0605
Phosphoric acid	0.0950
Chlorine	0.0058
Total	100.5880

This soil is all that could be desired for the culture of the grape; it contains an abundance of all the mineral substances which enter into the composition of the vine, as shown above by its analysis. While it is *warm*, *light* and *dry*, it contains large quantities of magnesia and vegetable matter or humus, giving it great capacity for absorbing and retaining a sufficient quantity of moisture, even in the droughts of summer. This is a fair representation of the soils on the Magnesian Limestone ridges and slopes throughout Central and Southern Missouri. These slopes and ridges occupy millions of acres now deemed worthless, which are, in fact, by far the most valuable lands in the State for the cultivation of the grape; especially is this true of those located upon the southern highlands, away from the vapors and sudden changes of our large rivers and their broad valleys.

The Magnesian Limestone Series occupies a large portion of Southern Missouri, and is made up of magnesian limestones, sandstones, and porous chert, which are usually overlaid with thin beds of reddish-brown marly clays. The sand, lime, magnesia, and alumina, derived from the decomposition of these rocks, together with the abundance of vegetable matter and the alkalies derived from the fires which annually overrun this country, combine to form a soil* *light*, *dry*, *warm*, and rich in *potash*, *soda*, *lime*, *magnesia*, and all the other mineral ingredients needed to render it fertile, and suitable in an eminent degree for the culture of the vine. In many places this soil is underlaid with a sufficient quantity of pebbles and fragments of porous chert to constitute a most thorough system of drainage; while in others the fragments of chert are disseminated through the soil in such quantities as to injure it somewhat for ordinary cultivation, but giving precisely the preparation so highly recommended by Virgil and later authors, and the best cultivators of the grape. It is true that the native vines do not grow so large and sappy on this as on the deep, damp soils of the State; but they are nevertheless strong and healthy, and produce finer clusters of larger and better grapes. This improvement was particularly observed in the *Muscadine*, the *Northern Fox*, and the *Summer Grapes*.

This variety of soil also extends over a large portion of the counties on both sides of the Osage, and over the southern part of Boone, Callaway, Montgomery, and Warren, on the north side of the Missouri, occupying in all an area of some 15,000,000 acres. Of these, at least 5,000,000 acres might be selected in the most desirable localities and devoted to vineyards, without encroaching upon the lands most desirable for

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* See preceding analysis No. 14.

F. B. PRICE DEL. J. M. [illegible] ENGRAVER.

BLUFFS OF MAGNESIAN LIMESTONE ON THE NIANGUA 3 MILES N.W. OF GUNTERS SPRING, SHOWING THE NATURAL TERRACES SO COMMON IN THE BLUFFS OF THAT STREAM.

other departments of agriculture. And so far as we can judge from the characteristics of soil and climate and the indications of the native vines, these 5,000,000 acres in the highlands of Southern Missouri present rare inducements to the vine-dresser—such a combination of favorable circumstances as will not fail to attract the attention of those who would engage in this most pleasant and profitable department of husbandry. And so important will be the results, that every effort should be put forth to hasten the time when these 5,000,000* acres shall be covered with flourishing vineyards, giving profitable employment to 2,000,000 people, yielding more than 1,000,000,000 gallons of wine, and an annual profit, at the lowest estimate, of $500,000,000. And what is still more important, the pure nourishing juice of the grape would take the place of the vile, maddening compounds used under the names of wine and brandy; drunkenness would give place to sobriety; and our people, nourished by the grape and its pure wines, would become as robust and hardy as they are now daring and indomitable.

Natural Terraces.—The bluffs of the numerous streams in Southern Missouri, and in the valley of the Osage, usually slope back into knobs and ridges, which are frequently surrounded by numerous natural terraces so regular and uniform that they appear like the work of human hands, as seen in Plate VIII. These terraces are produced by the decomposition of the strata of magnesian limestones which form the bluffs. Their height varies from one to six feet, and the width of the top from two to twelve, according to the angle of the slope and the height of the terrace. Their surfaces are nearly level, and usually covered with a light, warm and rich soil, containing fragments of chert and the decomposing limestone, all wonderfully prepared by nature for the planting of vineyards. These terraces generally surround high, open ridges and knobs, exposed to the free circulation of the dry atmosphere of the region under consideration. We have observed but one objection to their use for vineyards. In some places the soil does not appear sufficiently deep to secure the vine against the effects of droughts. But, as an offset to the want of depth, it always contains large proportions of carbonate of magnesia and humus, which give a great capacity for absorbing and retaining moisture; as these substances possess this capacity to a greater degree than any of the other ingredients of our soils. And besides, the thinnest soils on these terraces

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* France has about 5,000,000 acres in vineyards. They yield about 925,000,000 gallons of wine, besides the 95,000,000 gallons distilled into brandy, and give profitable employment to 2,000,000 of people, mostly women and children.

sustain a vigorous growth of prairie grasses, flowers, shrubs, and vines which produce the finest quality of grapes in great profusion.

Caves.—There are numerous spacious caves in all parts of this interesting country. The temperature of those measured ranges between 50° and 60° F. Many of them would make most excellent wine cellars, as their temperature is sufficiently low and uniform to prevent that acidity to which the wines of all temperate latitudes are predisposed. It should also be borne in mind that this is the richest mineral region in the Mississippi Valley. It abounds in mines of Lead, Zinc, Copper, Cobalt, and mountains of Iron, and quarries of Marble; and, besides, its agricultural resources are sufficient to sustain a population of many millions.

These facts respecting the *native vines*, the *climate*, the *experience of our vine-growers*, and the *soil*, clearly prove the capacity of Missouri to become the great wine-growing region of our continent. They should encourage those noble spirits who havė so faithfully devoted their labor and their money to promote this important department of husbandry in our midst; for the time is not far distant when the "*poor flint* ridges" and *terraced slopes* of Southern Missouri will be as valuable for vineyards as some of them are now for their rich mineral deposits. The vine-clad hills of the beautiful Niangua will vie in wealth with the leaden veins of Potosi and Granby.

Was Man cotemporaneous with the Mastodon?

BY A. WISLIZENUS, M.D.

In the first volume of the Transactions of the Academy a paper was published by Dr. A. Koch, tending to prove the cotemporary existence of Man with the gigantic Mastodon. Dr. Koch states therein, that, in 1839, he discovered in the bottom of the Bourbeuse River (Gasconade County, Missouri), near a spring, the bones of a *Mastodon giganteus*, more or less burned by fire. He states, that the skeleton was found standing upright, as if the animal had been mired; and that those portions which had been exposed above the surface, especially the head, the spine, and the ribs, had been partially consumed by fire. On the surface of the clay, covering the bones, was found a layer of wood-ashes, mingled with pieces of burned bones, a large number of broken pieces of rocks, also several stone arrow-heads, a stone spear-head, and some stone axes. This mixed layer was covered by alluvial deposits, from eight to nine feet thick. From these data Dr. Koch draws the conclusion that the Mastodon, while mired, was killed by weapons, stones, and fire; and that Man must, therefore, have existed with the Mastodon.

This paper of Dr. Koch, although many members of the Academy disagreed with the author's views, passed from the hands of the examining committee to the press without any comment upon it and without a discussion. Since, however, in the last meeting, the subject was incidentally brought again before the Society, and a wide difference of opinion was manifested in regard to the correctness of Dr. Koch's conclusions, I take this opportunity of expressing my belief, and of trying to convince the members, that all the facts, stated by Dr. Koch, can be accounted for in a far more simple and natural way, than by the hasty and thus far unwarranted supposition, that man has existed cotemporaneously with the mastodon.

To substantiate the statements in the case more firmly, it would certainly have been desirable that Dr. Koch had saved those small remains of the head, by which he recognized the mastodon, also the stone weapons and the wood-ashes, with the burnt bones and broken pieces of rock, and that he had submitted them to a critical, chemical, and microscopic examination. Exact measurements, too, and a diagram of the whole locality would have been preferable to mere estimates and a rather loose narrative.* But, as Dr. Koch has acquired some experience in digging up fossil bones, I will assume that all his observations and statements of what he found are strictly correct, and will base my explanation of them upon the following grounds:

1. The mastodon standing upright was, no doubt, mired in a soft, swampy ground (caused perhaps by the vicinity of the spring), and perished in that position. That antediluvian animals have often perished thus, is a well established fact; sometimes crowds of them have been found, standing upright and pressed closely together, as if a sudden land-slide had buried them all simultaneously.

2. That fire has been burning there, and not an accidental one, but a continuous, intense fire, lighted by man for some purpose, seems also to be certain from the quantity of wood-ashes accumulated, said to be from two to six inches thick. But the fire was apparently not made below or around the animal, but on the top of it, and had extended but a few feet from that centre. Therefore, those portions only which were exposed

* Dr. Koch has informed the Academy at a later period, that all these objects mentioned were collected and saved by him, and are now in the Museum of Berlin. But as my views were not at all based upon their absence, it does not, of course, in the least invalidate my arguments.

above the surface, as the head, spine and ribs, were found partially burned, while the lower parts were undisturbed; therefore the head, the highest part, was burned to such a degree, that but small remains of it were left unconsumed. Now, if men, as Dr. Koch supposes, had found the mastodon there while being mired and alive, and, unable to kill it in that helpless condition by weapons and stones, had resorted to fire, is it likely that they would have made a fire above the animal instead of around it; and, after having triumphed by such unusual efforts over the huge animal, is it likely that they would have left its body quite undisturbed, without even taking a trophy along, as they are wont do after a combat with far inferior animals? Or, would the wood-ashes in that case, have formed such an equal layer above the animal? would they not rather have fallen from the protruding higher parts to the ground and have been washed off by the rains, or been blown by the winds in all directions, before alluvial ground could cover the spot? These are all questions that can not be satisfactorily answered by Dr. Koch's theory.

3. The arrow-heads and stone weapons seem to prove the presence of Indians on that spot,—not of antediluvian Indians, cotemporaries of the mastodon, but of the same Indians that have, no doubt, for thousands of years occupied this, their native continent, preserving their peculiarities of body and mind, their languages, their customs and habits, from the oldest times down to the present day.

The following combination of circumstances appears to my mind the most natural and likely to solve the question:

An Indian family, attracted perhaps by the springs, selected centuries ago that place for a residence, and fixed their tent or wigwam on the very spot, where, unknown to them, the bones of the mastodon rested below. The ground, covering and hiding the bones, formed then but a superficial layer, perhaps of one foot in depth. Whether that was its original depth at that time, or whether part of the ground had been removed, either by natural agencies or by human interference, it is now impossible to decide and quite immaterial to the question. For our purpose it is sufficient to assume, that an Indian family, under such circumstances, fixed their lodge there and lived there for some time in their usual way. Now, everybody, who has seen anything of Indian life, knows that cooking and roasting form a part of domestic duties in savage life as well as in a more refined one, with the difference, only, that the Indian kitchen is far more simple, and that they use neither stove nor hearth, but make their fires, especially in the colder season, in the midst of their lodges, on the bare ground, in a hollow circle. That by such daily fires, kept up for months, perhaps for years, a deep hollow would be formed in the ground and a layer of ashes be therein collected, and that by these daily repeated fires and heated ashes underlying bones could be partially burned, is self-evident. But the Indians, like many other primitive nations, are also in the habit of preparing sometimes their food, especially their meat, in holes dug in the ground and filled up with alternate layers of heated stones, meat and embers. Such underground kitchen work would, of course, exert a still more powerful and speedy effect in partially burning underlying bones, and would account, at the same time, for the presence of stones in the ashes. Their presence might also be accounted for by the Indian custom of covering the lower end of their tents with stones, to keep them closer to the ground. In a deserted Indian camp these stones will, for a long time afterwards, indicate the places where their lodges were fixed.

That in the course of centuries, after the spot was left undisturbed, alluvial ground could have accumulated over it to the depth of eight or nine feet, burying both the mastodon with its partially burned bones and the traces of the Indians, will scarcely need a word of comment.

This combination of simple and throughout natural circumstances, though it will by no means give us certainty, seems to me to deserve after all more credit than the forced explanation by assuming the coëxistence of man and the mastodon, for which no incontrovertible proof has as yet been given, or the still more fanciful suggestion of intelligent apes.

Dr. Koch mentions in the same paper another "evidence still more conclusive" for the same theory, to-wit: he found in another river bottom several stone arrow-heads mingled with the bones of a mastodon, one of them lying underneath the animal's thigh bone, "so that it could not have been brought thither after the deposit of the bones." It seems to me, that the interference of some burrowing animal and the agency of water, which is so paramount in river bottoms, would do away with that impossibility. Stone arrow-heads are widely spread over the State of Missouri, and are often found below the ground, unconnected with mounds, graves or bones. The agency of water no doubt changes sometimes their locality just as well as it controls the distribution of pebbles and other small stones.

THE TRIAS OF KANSAS.

BY F. HAWN.

A large portion of Kansas, extending westward to the Sixth Principal Meridian, seems to be underlaid by brown and yellow sandstones and clays. A similar formation also extends towards the south-west far into New Mexico, and to the north-west in the valley of the Missouri River as far up as the mouth of Judith River. In Eastern Kansas the formation is composed of sandstone, blue and variegated pyritiferous clays, gypsum, etc.

This formation in Kansas, in the north-west at the mouth of Judith River, as well as that of the Pyramid Mountain in New Mexico, have been referred to the Cretaceous system of Nebraska, Arkansas, Texas, Alabama, and New Jersey, etc.* At that time no organic remains had been found sufficient for an undoubted reference. But recently I obtained a few fossils from a stratum of this group in Kansas that would place them in the Permian below rather than the Cretaceous above; hence it was nominally referred to the Trias, as these beds rest nonconformably upon the Permian.

The surface upon which these Triassic strata were deposited was very uneven. Frequently we find Permian beds standing up through them in ridges which must have represented reefs in the ancient waters in which the Trias was deposited. Indeed there may be traced from the valley of the Kansas to the Arkansas a line of coast, with its littoral configurations, reefs and islands. The Upper Permian strata form the eastern boundary between those points, and dip towards the west at the rate of from eighty to one hundred feet per mile, and pass under the Triassic beds. The scenery then undergoes a radical change, from that of a high, rôlling, broken region, to a gently undulating surface, to which the appropriate term "plains" has been universally applied. This change may be realized in travelling the Santa Fé road from Diamond Spring to the Cottonwood.

The Cellular Limestone, on which the Trias rests, is variable in character. It is usually a brown and yellow cellular magnesian limestone, often laminated and traversed by thin plates (which are sometimes waved) forming rectangular cells. These cells are often coated with brown mammillated chalcedony, or partially filled with small rhombic, translucent crystals of calcareous spar. Sometimes they contain a reddish-brown pulverulent substance. The surface presents a very rough exterior, with numerous sun-cracks. The strata often pass into a brecciated conglomerate, the fragments more or less comminuted and water-worn. The beds thus constituted are of variable thickness, and alternate with heavy beds of coarse brown, and fine white and blue pyritiferous clay, containing a bed of white granular gypsum. The cellular beds often pass diagonally through the clayey strata.

The fragmentary character of these beds, and the sun-cracks so abundant in them, show very clearly that they were formed on a shore of the sea.

In that era, the valley of Kansas, from the mouth of the Smoky-Hill Fork to Ft. Riley, must have had nearly the same contour as it now possesses, for there we find a lower member of the Trias in outliers lying nonconformably over the Lower Permian on the north slope of the valley, whilst on the south side the latter formation is found in regular beds one hundred and fifty feet above the outliers on the north.

The Permian strata constitute the formation between the valley of Kansas and Republican Fork, and previous to the deposition of the Trias formed a promontory extending west to the Sixth Principal Meridian, against which the latter was deposited.

The sandstone of the Trias probably exerts an important influence. It furnishes the drift-sand at the mouth of Little Arkansas, and west to the crossing of the Santa Fé road, where it forms the "Sand-Hills," and probably furnishes the sand of the arid plains of the south-west.

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* Published Notes of the Country bordering on the Missouri River, by Messrs. F. B. Meek and F. V. Hayden, M.D., p. 19. (See Proceedings of the Academy of Natural Sciences of Philad., May, 1857.)

THE ROCKS OF KANSAS.

BY G. C. SWALLOW AND F. HAWN.

In presenting the following paper to the scientific world, we feel it incumbent upon ourselves to state that it was prepared in great haste, in the midst of other pressing duties; and that the specimens, in many cases, are very imperfect, and would not permit us to determine with certainty all of the specific characters. Where we have represented them as identical with species heretofore described, the proofs of identity are conclusive; where there have been any slight differences, these have been fully stated. Some of those specimens so imperfect that it was impossible to determine whether they are or are not identical with European forms, have, in consideration of the interest which will be felt in knowing all the relations of these new rocks, been deemed worthy of a place in our paper; and we have stated what seems to us to be their most obvious relations to well known European forms, as it is never safe or advisable to form new species on imperfect specimens.

Whatever defects may appear in our descriptions of new species, the characters given can be relied upon as true to the original specimens.

The great importance of these rocks to scientific and practical men* has induced us to present the results of our first hasty examinations, with the promise that we will, at an early day, give our conclusions more in detail, when we have completed the examination of all the collections which will be in our possession.

Our Geological Map of Kansas will show a large development of the Permian Rocks of that Territory, and the still wider range of those beds between the Permian and the Cretaceous, which we suppose may prove to be Triassic.

The following section gives the rocks of Kansas as observed by Maj. Hawn during his lineal surveys in that Territory.

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* The many beds of gypsum which these rocks contain, will enable the farmer to convert the vast sandy plains of Central Kansas into the most productive regions of the West, and fill that wide wilderness with a teeming happy people. These beds will also supply the commercial demands of the Mississippi Valley.

SYSTEM I.—QUATERNARY.

No. 1—150 feet Bluff, the same as in Missouri—2d Ann. Rep. Mo. Survey.
" 2— 4 feet white clay—2d Ann. Rep. of Mo. Survey.
" 3— 15 feet local drift.

169 feet of Quaternary.

SYSTEM II.—CRETACEOUS.

No. 4—45 feet light gray crystaline limestone.*
" 5—27 feet slope strewn with light gray calcareous concretions.*

72 feet of Cretaceous.

SYSTEM III.—TRIASSIC. (?)

No. 6—12 feet light gray arenaceous limestone.
" 7—10 feet blue pyritiferous clay.
" 8—15 feet dark brown ferruginous sandstone.
" 9— 8 feet, like No. 7.
" 10—18 feet flesh-colored quartzitic sandstone.
" 11—14 feet variegated, red and white, clay.
" 12— 8½ feet white granular gypsum. (Local.)
" 13—12 feet, like Nos. 7 and 9.
" 14—20 feet dark brown ferruginous sandstone.
" 15—18 feet variegated, white and red, clay.
" 16—50 feet soft, coarse, buff sandstone.
" 17—30 feet pyritiferous clay.
" 18—10 feet yellowish brown argillaceous sandstone.
" 19—10 feet thin silico-calcareous strata, containing fragments of trees.
" 20— 8 feet brown impure lignite.
" 21—10 feet black pyritiferous clay, containing numerous stellated crystals of selenite.
" 22—60 feet gray, blue and brown clay, with thin seams of fibrous selenite, and flesh-colored nodules of gypsum.
" 23—75 feet soft, crumbling, brick-red sandstone.
" 24—17 feet white clay, with soft concretions of oxide of iron.
" 25—15 feet conglomerate of coarse sand and small brown pebbles.

420½ feet of Triassic. (?)

SYSTEM III.—PERMIAN.

UPPER PERMIAN.

No. 26—100 feet brown and yellow, cellular and brecciated limestone, alternating with brown, blue and white pyritiferous clay, containing a bed of white granular gypsum, 5 feet thick.
" 27— 18 feet conglomerate, of angular, water-worn fragments of limestone, cemented with white argillaceous matter. This bed is local, and may not have its true position.
" 28—15 feet, resembling No. 26, but more compact.
" 29—60 feet dark brown, silicious limestone, alternating with coarse, impure, brown clays, containing crystals of chalcedony and agatized quartz.
" 30—25 feet dark buff, compact limestone.
" 31—45 feet red clay.

LOWER PERMIAN.

No. 32—25 feet brown shale, containing geodes whose drusy cavities are filled with crystals of quartz, and reniform nodules of variegated white and red quartz, often agatized.

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* Major F. HAWN's section of Messrs. F. B. Meek and F. V Hayden's communications to the Academy of Natural Sciences of Philad'a. (*See Proceedings, May,* 1857.)

No. 33—30 feet gray limestone and flint, with beds of brown clay.
" 34—25 feet massive, cherty, magnesian limestone and brown clay; the lower magnesian beds contain angular fragments of jasper.
" 35—20 feet of brown clay, fossiliferous.
" 36—18 feet red clay.
" 37—60 feet silicious, yellow, magnesian limestone, with heavy beds of brown clay.
" 38—10 feet massive bed of flint and limestone.
" 39—25 feet gray and yellow limestone, containing small globular and pear-shaped nodules of chert, and geodes with crystals, alternating with beds of brown and blue clay.
" 40—75 feet brown magnesian limestone, alternating with beds of brown, olive-green and red clays.
" 41—25 feet light buff amygdaloidal-magnesian limestone and chert.
" 42— 8 feet heavy-bedded yellow, magnesian limestone.
" 43— 3 feet blue fossiliferous slate.
" 44—15 feet brown slate.
" 45—10 feet brilliant yellow, magnesian limestone.
" 46—17 feet dark brown limestone, with numerous joints of large *crinoidal* columns.
" 47— 4 feet light yellow silicious limestone.
" 48—30 feet red clay.
" 49— 8 feet silico-calcareous slate.
" 50— 5 feet olive-green clay.
" 51— 4 feet red clay.
" 52—10 feet dark gray limestone.
" 53— 6 feet olive-green slate.
" 54— 8 feet dark blue slate.
" 55— 6 feet buff limestone.
" 56—16 feet brown slate.
" 57— 3 feet dark blue slate.
" 58—13 feet gray clay.
" 59— 3 feet compact, light buff limestone.
" 60— 5 feet brown clay.
" 61—15 feet blue shale, fossiliferous.
" 62— 3 feet compact, drab, silicious limestone, with small nodules of chert.
" 63— 4 feet brown limestone.
" 64— 8 feet soft, light brown clay.
" 65—15 feet soft, olive-green clay, with a band of red clay, one foot thick.
" 66— 4 feet gray oolitic limestone.
" 67— 4 feet bright olive-green clay.
" 68— 6 feet dark, buff, oolitic limestone.
" 69— 5 feet dark blue slate.
" 70— 7 feet drab limestone.

Total, 820 feet of Permian Rocks.

SYSTEM IV.—CARBONIFEROUS.

1073 feet coal measures, a continuation of, and probably above, the Upper Coal Series of Missouri. (See 2d Mo. Rep. Part I., p. 78.)

NOTE.—The data for the above section, were obtained amidst onerous duties connected with the lineal surveys of the Territory, confining my observations to arbitrary lines and localities; this, together with a want of conformability in the strata near No. 26 of the foregoing section, renders some parts of it hypothetical, but I believe it is sufficiently accurate for general illustration.

F. HAWN.

CATALOGUE OF FOSSILS

Obtained from the Permian Rocks of Kansas.

NAMES OF SPECIES.	COAL MEASURES.	LOWER PERMIAN.	UPPER PERMIAN.	TRIASSIC (?).	LOCALITIES.
PLANTÆ.					
A trilobate leaf of an unknown exogenous plant	..	..	..	*	No. 14(?) of the forgoing section.
ZOOPHYTA.					
Stenopora crassa, *Lonsdale*	..	*	..	..	Valley of Cotton-wood.
Stenopora spinigera, *Lonsdale*	..	*	..	..	Rock Creek, Santa Fé road.
Chætetes, three species, (*undetermined*)	..	*?	..	..	Valley of Kansas, west of Fort Riley.
BRYOZOA.					
Fenestella flabellata (?), *Phillips*	..	*	..	..	Near Council Grove.
Synocladia virgulacea (?), *King*	..	*	..	..	Valley of Cotton-wood.
Thamniscus dubius, *Schlotheim*	..	*	..	..	Valley of Cotton-wood.
Acanthocladia anceps (?), *Schlotheim*	..	*	..	..	Near Hay's Ranch.
Phyllopora Ehrenbergi, *Geinitz*	..	*	..	..	Valley of Cotton-wood.
ECHINODERMATA.					
Archæocidaris Verneuiliana, *King*	..	*	..	..	Near Lost Spring, S. Fé road.
Cyathocrinus ramosus (?), *King*	..	*	..	..	Near Council Grove.
ANNELLATA.					
Serpula (Spirorbis) valvata, *Goldfuss*	..	*	*	..	Near Smoky-Hill Fork.
Spirorbis orbiculostoma, *Swallow*	..	*	..	..	Valley of Cotton-wood.
CRUSTACEA.					
Phillipsia, *species not determined*	..	*	..	..	Near Council Grove.
BRACHIOPODA.					
Productus Calhounianus, *Swallow,*	..	*	..	..	Valley of Cotton-wood.
Productus semireticulatus, *Martin,*	*	*	..	..	Valley of Cotton-wood.
Productus Rogersii. *Norwood & Pratten*	*	*	..	..	South Fork Cotton-wood.
Productus æquicostatus, *Shumard,*	*	*	..	..	Valley of Kansas, W. Ft. Riley
Productus Norwoodii, *Swallow*	..	*	..	..	Valley of Cotton-wood.
Spirifer cameratus, *Morton*	*	*	..	..	Rock Creek, Santa Fé road.
Spirifer planoconvexa, *Shumard*	*	*	..	..	Valley of Cotton-wood.

NAMES OF SPECIES.	COAL MEASURES.	LOWER PERMIAN.	UPPER PERMIAN.	TRIASSIC (?).	LOCALITIES.
Spirifer pectinifera (?), *Sowerby* ..	*	*	..	..	Valley of Big Blue.
Chonetes Flemingii, *Norwood & Pratten* ..	*	*	..	..	Near Council Grove.
Orthisina umbraculum, *Buch*	*	*	..	..	Generally diffused.
Orthisina Shumardiana, *Swallow* .	..	*	..	..	Red Water and Cotton-wood.
Orthisina Missouriensis, *Swallow* .	*	*	..	..	Red Water.
Rhynchonella Osagensis, *Swallow*,	*	*	..	..	Valley of Big Blue River.
Terebratula(?) subtilita, *Hall*	*	*	..	..	Generally diffused.
ACEPHALA.					
Monotis speluncaria(?), *Schlotheim*,	..	*	..	..	
Monotis " var. Americana, *Swallow* ..	..	..	*	..	Near Smoky-Hill Fork.
Monotis radialis, *Phillips*	..	..	*	..	Near Smoky-Hill Fork.
Monotis variabilis, *Swallow*	..	..	*	..	Valley of Cotton-wood.
Monotis Halli, *Swallow*	..	*	*	..	Valley of Cotton-wood.
Avicula gryphæata(?), *Munster* ..	..	..	*	..	Near Smoky-Hill Fork.
Pecten Cleavelandicus, *Swallow* ..	..	*	..	..	Valley of Cotton-wood.
Pecten ringens, *Swallow*	..	*	..	..	Valley of Cotton-wood.
Pecten acutialatus, *Swallow*	..	*	..	..	Valley of Kansas.
Mytilus (Myalina) Permianus, *Swallow* ..	..	..	*	..	Valley of Kansas.
Mytilus (Myalina) concavus, *Swallow* ..	..	..	*	..	White Water.
Mytilus (Myalina) squamosus, *Sowerby* ..	..	*	..	..	Valley of Cotton-wood.
Mytilus (Myalina) rectus, *Shumard*	*	*	..	..	Valley of Verdigris.
Myalina subquadrata, *Shumard* ..	*	*	..	..	Valley of Verdigris.
Myalina Kansasensis, *Shumard* ...	*	*	..	..	Near Council Grove.
Bakevellia antiqua, *Munster*	..	..	*		Valley of Kansas.
Bakevellia pulchra, *Swallow*	..	*	..	..	Valley of Kansas.
Edmondia gibbosa, *Swallow*	..	*	..	..	Valley of Cotton-wood.
Edmondia Otoensis, *Swallow*	..	*	..	..	Valley of Cotton-wood.
Edmondia semiorbiculata, *Swallow*	..	*	..	..	Council Grove.
Nucula (Leda) Kazanensis, *Vern.*	..	*	..	..	Valley of Cotton-wood.
Nucula speciosa(?), *Munster*	..	..	..	*	No. 18 of foregoing section.
Nucula, (*species not determined*).					
Solemya Biarmica(?), *Verneuil* ...	..	*	..	..	Valley of Kansas.
Solemya, (*species undetermined*) ...	..	..	*	..	Smoky-Hill Fork.
Solen(?) Permianus, *Swallow*	..	..	*	..	Smoky-Hill Fork.
Cardiomorpha rhomboidea, *Swal.*	..	*	..	..	Council Grove.
Cardiomorpha Kansasensis, *Swal.*	..	*	..	..	Valley of Cotton-wood.
Cardinia cordata, *Swallow*	..	*	..	..	Valley of Cotton-wood.
Cardinia subangulata, *Swallow* ...	..	*	..	..	Valley of Cotton-wood.
Cardinia, (*species undetermined*).					
Cardinia Listeri(?), *Sowerby*	..	..	..	..	
Pleurophorus(?) Permianus, *Swal.*	..	*	..	..	Smoky-Hill Fork.
Schizodus obscurus, *Sowerby*	..	*	..	..	Valley of Cotton-wood.

NAMES OF SPECIES.	COAL MEASURES.	LOWER PERMIAN.	UPPER PERMIAN.	TRIASSIC (?).	LOCALITIES.
Schizodus triangularis, *Swallow*	..	*	..	..	Valley of Cotton-wood.
Schizodus Rossicus, *Verneuil*	..	..	*	..	Smoky-Hill Fork.
Lyriodon (Myophoria) orbiculare, *Goldfuss*	..	..	..	*	No. 18 foregoing section.
Allorisma lanceolata, *Swallow*	..	*	..	..	Near Council Grove.
Allorisma curta, *Swallow*	..	*	..	..	Near Council Grove.
Allorisma Minnahaha, *Swallow*	*	*	..	..	Near Council Grove.
GASTEROPODA.					
Murchisonia subangulata(?), *Vern.*	..	..	*	..	No. 26 foregoing section.
Murchisonia Kansasensis, *Swallow*	..	*	..	..	Valley of Cotton-wood.
Murchisonia perversa, *Swallow*	..	*	..	..	Valley of Cotton-wood.
Loxonema fasciata, *King*	..	*	..	..	Valley of Kansas.
Macrocheilus spiratus, *McCoy*	..	*	..	..	Valley of Kansas.
Naticopsis Pricei, *Shumard*	*	*	..	..	Valley of Kansas.
CEPHALOPODA.					
Nautilus Permianus, *Swallow*	..	..	*	..	Smoky-Hill Fork.
Nautilus occidentalis, *Swallow*	..	..	..	..	Valley of Cotton-wood.
Orthoceras Kickapooense, *Swallow*	..	..	*	..	Smoky-Hill Fork.
Cyrtoceras dorsatum, *Swallow*	..	..	*	..	Smoky-Hill Fork.

FOSSILS OF THE PERMIAN ROCKS OF KANSAS.

PLANTS.

A trilobate leaf of an exogenous plant, is the only fossil plant in the collection belonging to the beds above the Permian.

ZOOPHYTA.

STENOPORA CRASSA, *Lonsdale*, Ge. Rus., Vol. I., p. 632, pl. A, fig. 12.

CALAMOPORA MACKROTHII, *King*, Per. Fos., pl. III., figs. 3–6.

CHAETETES (?) MACROTHII, *Edwards and Haime*, Brit. Fos. Corals.

Whatever may be the generic and specific relations of the above corals, I will not pretend to decide among the conflicting opinions; but our specimens agree with Lonsdale's in every particular indicated in his figures and descriptions. They do not show the *mural foramina* of King's figures.

STENOPORA SPINIGERA, *Lonsdale*, Ge. Rus., Vol. I., pl. A, fig. 11.
STENOPORA COLUMNARIS, *King*, Per. Fos., pl. III., figs. 7–9.

Our specimens agree with those delineated by Lonsdale and King, except they are not "incrusting" like some of King's.

Both of the above species of Stenopora are from the Lower Permian rocks in the valley of the Cotton-wood, associated with *Monotis Halli*.

CHAETETES. Three undetermined species, probably new.

All of these corals were obtained in strata supposed to be Lower Permian of Kansas Territory. They are very abundant in some of the beds.

BRYOZOA.

FENESTELLA FLABELLATA (?), *Phillips*, Ge. York, Pt. II., pl. I., fig. 7–10.

Our specimen presents the striated surface only; all the characters displayed are like those delineated by Phillips.

Lower Permian strata, near Council Grove, K. T.

SYNOCLADIA VIRGULACEA (?), *Phillips*, Trans. Ge. Soc. Lon. 2d Series, Vol. III., pl. XII., fig. 6, p. 120; and the Encyclopedia Metropolitana, pl. III.
SYNOCLADIA VIRGULACEA(?), *King*, Per. Fos., p. 39, pl. IV., figs. 1–8.

It is impossible to tell whether our specimens are identical with those figured and described by Phillips, as cited above; but they differ from King's in having but two or three rows of *cellules*, generally two. His species is described as having from "three to five" rows of *cellules*. Whether the specific characters should be so extended as to include those specimens with two rows only, as seems most reasonable, is left for others to decide. *S. biserialis* would be a good name for our species, unless it be included in the *virgulacea*.

From the Lower Permian strata in the valley of the Cotton-wood, K. T.

THAMNISCUS DUBIUS, *Schlotheim*.
GORGONIA DUBIA, *Goldfuss*, Pet. Ger., p. 18, pl. VII., fig. 1.
THAMNISCUS DUBIUS, *King*, Per. Fos. p. 44, pl. 5, figs. 7–12.

There can be no doubt of the identity of our fossils with those figured and described by Goldfuss and King.

From the Lower Permian strata in the valley of the Cotton-wood, K. T.

ACANTHOCLADIA ANCEPS (?), *Schlotheim.*

GORGONIA ANCEPS(?), *Goldfuss* (?), Pet. Ger. p. 98, pl. XXXVI. fig. 1.

ACANTHOCLADIA ANCEPS(?), *King* (?), Per. Fos. p. 48, pl. V., figs. 13–18.

Our specimens differ in having the rows of *cellules* diagonal to the axis of the stem, instead of longitudinal, as represented by King, and on ridges like that figured by Goldfuss; they are less regularly branched, and not so distinctly pinnated as those delineated by Goldfuss and King. Should these differences entitle our fossils to a specific distinction, *Americana* would be a good name.

Lower Permian strata in the valley of the Cotton-wood, K. T.

PHYLLOPORA EHRENBERGI, *Geinitz.*

PHYLLOPORA EHRENBERGI, *King*, Per. Fos., p. 43, pl. V., figs. 1–6.

PHYLLOPORA EHRENBERGI, *Pictet*, Tra. Palæ., pl. XCII., fig. 16.

Our specimens from the Lower Permian strata in K. T. seem to be perfectly identical with the specimen figured and described by King and Pictet.

ECHINODERMATA.

ARCHÆOCIDARIS VERNEUILIANA, *King*, Per. Fos., pl. VI., figs. 22–24.

ARCHÆOCIDARIS ACULEATUS(?), *Shumard*, Trans. Acad. Sci., St. Louis.

Our specimens seem to be identical with those delineated by King.

Near the junction of the Upper and Lower Permian strata west of Council Grove, K. T.

CYATHOCRINUS RAMOSUS (?), *King*, Per. Fos., pl. VI., figs. 15–21.

We have one plate and several internodes from near the junction of the Upper and Lower Permian rocks, west of Council Grove, which are very analogous to the above fossil described by King, but probably specifically different.

ANNELLATA.

SERPULA (*Spirorbis*) VALVATA, *Goldfuss*, Pet. Ger., p. 225, pl. 67, fig. 4.

This species from the Muschelkalk seems to be identical with one of our species from the Upper Permian strata of K. T.

SPIRORBIS ORBICULOSTOMA, *Swallow.*

Shell small; spire elevated; volutions about three; convex on the free side and marked with transverse rugæ; aperture oblique, sub-orbicular, not modified by the preceding volution; umbilicus small.

Our shell differs from the *S. valvata.* of Goldfuss, which it most resembles in the number of volutions and the transverse rugæ; and from *S. helix* of King, (Per. Fos., p. 54, pl. VI., figs. 10–11,) in the form of the aperture.

Maj. Hawn's collection from the Permian Strata of Kansas, attached to *Nautilus Permianus* and *N. occidentalis.*

CRUSTACEA.

PHILLIPSIA. Species not determined.

From the Lower Permian strata, on a slab with *Thamniscus dubius* and *Acanthocladia anceps* (?).

BRACHIOPODA.

PRODUCTUS CALHOUNIANUS, *Swallow.*

Shell, large, sub-hemispherical; *sinus*, narrow, extending from the visceral region to the anterior border of the dorsal valve; *beak*, small, recurved beyond and within the cardinal border; *ears* large, triangular, strongly arched, curving towards the cardinal border, ornamented with numerous tubular spines, those on the cardinal border somewhat regularly arranged in parallel rows; *cardinal border*, as long as the greatest width of the shell, the extremities somewhat reflexed towards the visceral region of the dorsal valve; *dorsal valve*, regularly arched, with a curve constantly increasing from the anterior border to the beak, ornamented with numerous, somewhat irregular, longitudinal costæ, narrow and prominent towards the beak, but broader and more flattened towards the anterior margin, their number increased by insertion and subdivision; the whole surface ornamented with tubular spines, which are more numerous towards the borders and on the ears, and usually spring from the costæ; *visceral region*, for a short distance from the beak, marked with irregular, concentric, waving, more or less prominent rugæ; *ventral valve*, strongly arched, slightly flattened on the visceral region and towards the anterior margin, ornamented with costæ and rugæ, like the opposite valve; *mesial ridge*, corresponding to the dorsal sinus; *internal surface* of ventral valve garnished with a prominent trifid *cardinal process*, fortified at its base with three diverging ridges, two extend laterally nearly parallel to the cardinal line and become obsolete on the ears; the third or the mesial ridge, extends perpendicularly from the cardinal border to the middle of the valve, where it becomes prominent and sharp; on each side of the last, and in the angles between it and the two former ridges, are the oval rugose scars of the *adductor muscles; vascular impressions*, ovate, nearer the anterior and lateral borders, connected by recurved sinuses to the anterior part of the mesial ridge; *central portion* of the visceral region punctate and marked with longitudinal costæ; around the anterior border is a zone, ornamented with tubes, those on the inner portion large and prominent, while those nearer the border are small, depressed and more numerous. Interior of dorsal valve marked with oblong, elliptical rugose *adductor muscles*, separated by a deep, narrow, longitudinal sinus.

Length from beak to anterior border, 1.65; breadth, 2.25; height of dorsal valve, 1.15.

The *Calhounianus*, so far as observed, is confined to the Lower Permian.

The variety *Kansasensis* ranges down to the base of the Carboniferous System. They were found very abundant by Major Hawn in Kansas.

By request of Major Hawn, this magnificent species is named in honor of Gen. John Calhoun, Surveyor General of Kansas, whose liberal official policy enabled Major Hawn to make the Geological survey of that Territory.

PRODUCTUS (*Strophalosia?*) NORWOODII, *Swallow*.

Shell thin, of medium size, hemispherical, somewhat depressed, ornamented with indistinct concentric rugæ and numerous small tubular spines; *dorsal valve* arched, curve regularly increasing from the anterior margin to the beak; *mesial sinus* well defined in some specimens, obsolete in others; *cardinal margin* slightly curved, less than the greatest width of the shell; *cardinal line* sub-linear, expanded beneath the beak into a narrow area, which is divided by a small deltoid aperture; *ears* of medium size, sharply defined, triangular, arched, rugose, ornamented with numerous spines inclined towards the posterior lateral angles, which are well defined, and vary but little from right angles. *Ventral valve*, sub-orbicular, narrowed towards the posterior border so as to present an ovate form, truncated by the cardinal margin, slightly concave, with a semi-circular depression parallel to the anterior margin; *ears* rugose, separated from the visceral region by a ridge more or less distinct; *trifid cardinal process* curves up under the beak and closes the aperture; in front of the cardinal process is a flat, narrow area. Both valves are ornamented with irregular, indistinct, concentric corrugations or lines of growth, which rarely assume the form of thin, scaly laminæ; they are most distinct near the beak and the anterior margin; numerous small, unequal, depressed tubular spines are developed on all parts of the surface, even to the point of the beak; their attachments make the shell appear as if marked with small, rounded, interrupted, longitudinal costæ; they are smaller on the ventral valve. In some specimens there are indications of an effort to range them in concentric lines, particularly near the margins; but usually there is no perceptible order, which together with the narrow area of the dorsal valve, and other characters, gives the shell strong affinities with the *Productus horrescens* of Verneuil.

Length of dorsal valve, 1.08; greatest width, 1.11; height, 0.55; length of cardinal line, 0.87; length of ventral valve, 0.91; width, 1.07.

The *P. Norwoodii* may be distinguished from the *P. horrescens* of Verneuil, by its entire beak and smaller area; and from the *P. Rogersii, N. & P.*, which it faintly resembles, by the want of large concentric ridges, and by the smaller size and greater number, and irregular arrangement of the spines. The *Strophalosia Morrissiana*, King, has a larger area.

Major Hawn's collection from the Lower Permian Rocks, in the valley of the Cotton-wood, where it was associated with *Thamniscus dubius*, *Productus Rogersi*, and *Monotis Halli.*

ORTHISINA SHUMARDIANA, ***Swallow.***

Shell **depressed, transverse, sub-orbicular, each valve marked with about ten irregular, broad depressed, rounded, radiating plications, which become obsolete towards the beaks; the whole surface is ornamented with prominent, nodular, rounded, radiating striæ, and by smaller concentric lines, which are themselves finely striated; the concentric striæ most obvious between the radiating lines; the latter are increased by implantation.** ***Dorsal valve*** **semi-conical, highest at the beak, depressed in the center, and in a circular zone parallel to the anterior margin;** ***beak*** **pointed, semi-conical, often slightly oblique;** ***area*** **triangular, vertical, base the longest side, decussate with fine striæ; aperture elongated, sub-deltoid, closed with a convex, transversely rugose deltidium.** ***Ventral valve*** **convex, gibbous towards the beak, depressed near the junction of the lateral and cardinal margins, forming small, flat, obtuse ears, flattened towards the ventral margin, giving in many specimens a slight mesial sinus; very much incurved**

towards the beak, which is small and curved beneath the deltidium; *area*, very narrow or obsolete.

Length, 0.94; breadth, 1.25; thickness, 0.62; height of area, 0.28; width of area and length of cardinal line, 0.64.

Our shell differs from the *O. Missouriensis* in being less gibbous; area and deltidium wider, and not so high; *ribs* more depressed; radiating lines regular and continuous from the beaks to the margins. It also may be distinguished from the *O. eximia Ver.* (Ge. Rus. pl. XI. fig. 2, p. 192,) in the markings, although the two shells present the same general characters. M. Verneuil says of the *eximia*: "La surface est ornée de stries déliées, filiformes, deux ou trois fois plus étroites que les intervalles qui les separent," which is not true of our shell; and, besides, ours has concentric striæ.

Major Hawn's collection from the Lower Permian Rocks, in the valley of the Cotton-wood, K. T., where it is associated with *Thamniscus dubius*, *Monotis Halli*, and *Monotis variabilis*.

ACEPHALA.

Pecten Cleavelandicus, *Swallow*.

Shell of medium size, orbicular, oblique, with a deep, rounded sinus between each ear and the adjacent sides; *cardinal border* long, slightly curved. *Left valve* very convex, flattened towards the margins, particularly on the posterior slope, ornamented with broad, rounded, radiating costæ, crossed by fine concentric striæ, which are nearly obsolete on the ribs, large and more numerous towards the margin, increased by implantation; *anterior wing* large, triangular, marked with from eight to twelve radiating costæ, and coarse, transverse striæ, parallel to the anterior margin; *posterior wing* longer and narrower, marked with eleven radiating costæ, which are crossed by striæ parallel to the posterior border; *beak* pointed, depressed, extending nearly to the cardinal border. *Right valve*, plane or concave, marked like the one opposite, but the costæ are not so prominent; *posterior wing* nearly smooth, with a few fine rugæ parallel to its posterior border; *anterior wing* convex, strongly wrinkled parallel to its anterior border.

Length, 0.95; height from beak to base, 1.63; length of posterior wing, 0.48; length of anterior wing, 0.38.

Collected by Major Hawn, in the valley of South Cottonwood, K. T., where it is associated with *Monotis Halli*, *Nautilus occidentalis*, *Spirorbis orbiculostoma* and *Mytilus squamosus*.

Pecten ringens, *Swallow*.

Shell transversely elongate, ovate; *left valve* convex, with a rounded ridge extending from the beak to the middle of the ventral margin, and convex towards the posterior side; *ventral margin* angular in the middle, depressed towards the sides with which it forms obtuse angles; *lateral margins* nearly straight, converging to the beak; *anterior wing* triangular, separated from the body by a well-defined convex margin; a wide sinus separates it from the anterior lateral margin; *beak* small, depressed, projecting slightly beyond the cardinal margin.

Our specimens are imperfect, and show no surface markings, save a few irregular corrugations.

Height from beak to ventral margin, 0.95; length, 0.70; depth of left valve, 0.16.

Major Hawn's collection from the valley of the Cotton-wood, in Permian strata.

PECTEN ACUTIALATUS, *Swallow.*

Shell small, depressed, polished, inflated part of the left valve orbiculo-cuneate, rounded on the ventral margin; *anterior wing* long, narrow, acuminate, separated from the side by a deep, rounded sinus, and a sharply-defined boundary from the sinus to the back; *posterior wing* separated by a deep, narrow sinus; *cardinal border* as long, or longer, than the length of the shell; no surface markings seen, save some faint indications of wide, depressed, radiating costæ on the inflated part of the left valve. Our specimens have no well-preserved surfaces.

Length, 0.74; height from beak to ventral margin, 0.76.

Major Hawn's collection from the Permian Rocks in the valley of the Kansas.

MONOTIS HALLI, *Swallow.*

Shell ovate or sub-orbicular, somewhat oblique, inequilateral, irregularly plano-convex; *left valve* gibbous on the middle towards the beak, flattened near the lateral and basal margins, ornamented with radiating costæ; *costæ* smaller, or entirely obsolete near the beak, larger and more numerous towards the margin, unequal, usually two or more small ones between the larger, all armed with vaulted and tubular scales, which are larger, more prominent and numerous towards the margin; *beak* prominent, depressed or incurved, extending to or beyond the cardinal border; *posterior wing* of medium size, flat, sub-costate or rugose, sometimes spinose, outer angle obtuse; *anterior wing* thin, flattened, extending down into the sinus, impressed on the anterior margin of the convex part of the valve, marked with numerous sharp, sinuous wrinkles; *right valve* sometimes irregular, sub-orbicular, nearly plane, ornamented with costæ similar to those on the opposite valve, but usually more numerous and more densely set with vaulted and tubular scales; *anterior wing* narrow, lingulate, marked with irregular rugæ, separated from the valve below by the deep, bissiferous notch; *aperture* for *byssus* deep, funnel-form, with two semi-cylindrical channels, one extending out and upwards to the cardinal margin under the beak, the other obliquely down to the anterior margin; *posterior wing* obtuse, rugose, extending down to the sinus, depressed in the posterior border of the valve. On both valves the stages of growth are marked with concentric, scaly, crenulated laminæ, which are most numerous at the margin; they are crenulated, and seem to form the vaulted scales and spines on the costæ.

A large ovate specimen measured in inches:—Length, 2.00; breadth, from beak to ventral margin, 2.38; length of cardinal border, 0.85; depth of left valve, 0.38. Length of a small orbicular specimen, 2.00; breadth, 2.04; length of cardinal border, 0.85; depth of left valve, 0.48.

Our specimens are very nearly allied to the *M. Garforthensis*, King, (Per. Fos. pl. XIII., figs. 24–25); but ours have very unequal radiating costæ; the right valve is very distinctly costate on the inner side; its anterior ear is long, longitudinally rugose, with sides nearly parallel. It is also very distinct from *Ostrea spondyloides*, Schlot., as represented by Goldfuss, which Mr. King says, resembles his shell.

Our species is found in both divisions of the Permian Rocks of Kansas, in the valley of the Cotton-wood, and near Council Grove, associated with *Nautilus occidentalis*, *Monotis speluncaria*, *Monotis variabilis*, and *Pecten Cleavelandicus*.

MONOTIS SPELUNCARIA, *Schlotheim*.

MONOTIS SPELUNCARIA, *King*, Mon. Per. Fos., p. 155, pl. XIII., figs. 5–21.

VAR. AMERICANA,* *Nobis*.

I am unable to detect any specific differences between our specimens and those described by Mr. King. The fossil is very variable, and with a few specimens one might be disposed to make several species. They differ nearly as much from each other as they do from those figured in the Monograph of Permian Fossils. But there appear to be two points of distinction which are constant. The left valve of the Kansas fossils is not so elevated, and the inside of the right is marked with depressed, radiating costæ.

Major Hawn's collection from the upper division of the Permian strata, near Smoky-Hill Fork and Council Grove.

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* Since the above was written, Mr. Meek has published this shell under the name *M. Hawni*.

MONOTIS RADIALIS, *Phillips*, Enc. Met.

MONOTIS RADIALIS, *King*, Per. Fos., p. 157, pl. XIII., figs. 22–23.

Our specimens are identical with those figured and described by Messrs. King and Phillips.

Major Hawn's collection from the Upper Permian strata, near Smoky-Hill Fork, K. T.

MONOTIS VARIABILIS, *Swallow*.

Shell variable, oblique, inequilateral, transversely elongate, ovate; *left valve* more or less gibbous, regularly arched, ornamented with fine, radiating and concentric striæ; on the ventral and lateral margins are variable, radiating spinose, and scaly costæ extending from one-fourth to one-half of the distance from the margin to the beak, where they entirely disappear; *beak* small, pointed, depressed, extending to the border or a little beyond; the whole surface is marked with concentric lines of growth; *cardinal margin* oblique, posterior part more so than the anterior, slight sinus below the anterior wing. *Right valve* not seen.

This species is very easily distinguished by the peculiarity of its markings, by the smooth, finely-decussated visceral region, and the coarsely costate and spinose or scaly marginal zone. It is very variable in form.

Length, 0.88; height, from beak to the anterior margin, 1.31.

It most resembles the *M. radialis, Phillips*, in form; but it is larger and very differently marked.

Major Hawn's collection from the Lower Permian Rocks, in the valley of the Cotton-wood, K. T.

MYTILUS (*Myalina*) PERMIANUS, *Swallow*.

Shell elongate, sub-quadrilateral; *anterior margin* long, concave, depressed, so as to produce a somewhat flat or concave plane nearly as wide as the thickness of the shell; *cardinal margin* rather short and straight, meeting the anterior border at an angle of about 58°, and the posterior by an obtuse angle or abrupt curve; *posterior margin* long, convex, parallel to the anterior border for more than half of the length of the shell, curved rather abruptly towards the base, meeting the opposite slope in an abrupt curve nearer the anterior margin. *Each valve* is marked with an angular ridge extending from the beak to the opposite extremity; these ridges are very angular and parallel to the anterior margin for more than half the length of the shell, forming a sharp ridge between the flat anterior surface and the convex cardinal and posterior slopes; but they diverge from the line of the anterior margin, become rounded and depressed as they approach the basal extremity; *beaks* sharp, terminal, curved in and forward. The *surface* is marked with numerous imbricating lines of growth, sub-parallel, but most distant on the posterior basal slopes; on the flat anterior surface the lines of growth appear like fine striæ, slightly diverging towards the basal extremity; punctate under the magnifier.

Height from the beak to the basal extremity, 1.96; width from the anterior to the posterior margins, .86; thickness, .72.

Our shell differs from the *M. rectus*, Shumard, in having a concave anterior margin; beaks curved forward, posterior margin parallel with the anterior, and a more abrupt curve or angle between the cardinal and posterior margins. *M. vetustus*, Goldfuss, (Pet. p. 169, pl. 128, fig. 7,) from the Muschelkalk, is less curved on the anterior margin, not so thick and the extremity of the base not so near the anterior margin.

Maj. Hawn's collection from the Permian(?) strata in K. T.

MYTILUS (*Myalina?*) CONCAVUS, *Swallow*.

Shell short, triangular, marked with sub-imbricating laminæ or lines of growth, which are concentric on the posterior cardinal slopes, but straight and slightly diverging on the concave anterior surface. *Anterior margin* concave, nearly as long as the shell; *cardinal margin* long, straight or slightly convex; posterior basal margin regularly curved from the cardinal to the anterior margin, with both of which it forms angular junctions; *anterior slopes* so flattened as to present a sharply defined, even, concave surface as long as the anterior margin, and as wide as the thickness of the shell; cardinal and posterior slopes slightly convex, forming sharp edges on the corresponding margins; the ridges bounding the anterior surface are sharp, well defined and parallel to the anterior margin; *beaks* pointed, curved in and forward.

Height from beaks to base, 1.07; width from anterior to the posterior margins, 0.60; thickness, 0.40.

This shell may be distinguished from the *M. Permianus* by its shorter triangular form, longer cardinal, and shorter, more convex posterior margin, and by the more sharply defined and regularly concave anterior surface.

Maj. Hawn's collection from the Permian (?) strata in the valley of the Kansas, K. T.

MYTILUS SQUAMOSUS (?), *Sow.*

MYTILUS HAUSMANNI (?), *Goldfuss*, Pet. Ger., p. 168, pl. 138, fig. 2.

MYTILUS SQUAMOSUS, *King*, Per. Fos., p. 159, pl. XIV., fig. 1–7.

Our specimens are like the smooth variety mentioned and figured by King.

Lower Permian, valley of Cotton-wood, K. T.

BAKEVELLIA ANTIQUA, *Munster.*
AVICULA ANTIQUA, *Goldfuss*, Pet. Ger., p. 126, pl. CXVI., fig. 7.
AVICULA ANTIQUA, *Verneuil*, Geo. Rus., pl. XX., fig. 13.
BAKEVELLIA ANTIQUA, *King*, Per. Fos., p. 168, pl. XIV., figs. 28–34.

This fossil has a wide range; it is found in the Bunter Sandstein of Germany, the Permian strata of Russia and England, and the Upper Permian Rocks near Smoky-Hill Fork, Kansas Ter.

BAKEVELLIA(?) PULCHRA, *Swallow.*

Shell rather large, polished, elongate, depressed, with a ridge from the back to the posterior ventral angle, where it becomes obsolete, marked with indistinct concentric plications or lines of growth and a few radiating costæ on the posterior cardinal slope; *cardinal margin* oblique, long; *posterior wing* narrow, two-thirds as long as the shell, with a deep sulcus parallel to and near the cardinal edge; *ventral margin* slightly curved; *posterior extremity* oblique, most prominent near the ventral margin.

Length, 0.81; height at the beak, 0.32.

Lower Permian Rocks, in the valley of the Kansas.

AVICULA GRYPHÆATA(?), *Munster.*
AVICULA GRYPHÆATA(?), *Goldfuss*, Pet. Ger., pl. 116, fig. 10.

We have a cast from the Upper Permian(?) of Kansas which very much resembles this species.

EDMONDIA GIBBOSA, *Swallow.*

Shell gibbous, sub-equilateral, marked with regular concentric costæ, and very indistinct striæ; valves regularly convex or flattened toward the ventral margin, with rounded ridges from the beaks to the anterior and posterior ventral angles; beaks very large, gibbous, strongly incurved, approximate, sub-central; *cardinal margin* depressed, shorter than the shell; extremities narrow, posterior the longer, flattened near the end, rounded; anterior rounded, forming an angle with the cardinal margin; *lunule* and *escutcheon* broad and depressed; ventral margin regularly curved.

Length, 0.77; width, 0.48; thickness, 0.46.

Maj. Hawn's collection from the Lower Permian Rocks, in the valley of the Cotton-wood, K. T.

EDMONDIA OTOENSIS, *Swallow.*

Shell small, sub-orbicular, oblique, gibbous, inequilateral, or-

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namented with regular concentric costæ and striæ; *beaks* large and strongly incurved.

Maj. Hawn's collection from the Lower Permian Rocks, in the valley of the Cotton-wood, K. T.

EDMONDIA SEMIORBICULATA, *Swallow.*

Shell elongate, sub-elliptical, inequilateral, slightly convex, regularly curved at the extremities; posterior end, the wider marked with regular concentric plications with sharp prominent edges. *Beaks* sub-central of medium size, slightly inclined forward; *cardinal border* sub-rectilinear; *valves* regularly convex, flattened at the posterior cardinal border.

Length, 0.55; width, 0.39; thickness, 0.33.

Maj. Hawn's collection from near Council Grove, K. T., in Lower Permian Rocks, with *Monotis Halli.*

Our specimens very much resemble the *Edmondia Murchisonia*, King, (Per. Fos., pl. XIV., figs. 14 & 15,) but the plications are larger, the beaks more prominent and central, and the posterior margin more regularly convex.

NUCULA (*Leda*) KAZANENSIS, *Verneuil*, Ge. Rus., Vol. II., pl. XIX., fig. 14.

Upper and Lower Permian in Valley of Cotton-wood and near Smoky-Hill Fork, K. T., where it is associated with *Monotis Halli*, *Monotis speluncaria*, *Schizodus Rossicus* and *Schizodus triangularis.*

NUCULA SPECIOSA(?), *Munster.*

NUCULA SPECIOSA(?), *Goldfuss*, Pet. Ger., p. 152, pl. CXXIV., fig. 10.

We have an imperfect cast which resembles the above fossil of Goldfuss from the Muschelkalk.

It is from No. 18 of what we suppose may prove to be Triassic.

NUCULA—species not determined—from the Upper Permian strata, K. T.

SOLEMYA BIARMICA(?), *Verneuil*, Ge. Rus.

SOLEMYA BIARMICA(?), *King*, Per. Fos., p. 178, pl. XVI., fig. 7.

Our specimens are imperfect casts, but so far as the characters are shown they agree with this species from the Permian of Russia and England.

From the Upper Permian strata, near Council Grove.

SOLEN(?) PERMIANUS, *Swallow.*

Shell small, cylindrical, narrowed and flattened towards the posterior extremity, marked with fine distinct concentric striæ and large irregular lines of growth; cardinal line straight, or very slightly convex; anterior extremity rounded.

Length, 0.68; width, 0.44.

From the Upper Permian strata, near Smoky-Hill Fork, K. T.

CARDIOMORPHA (?) RHOMBOIDEA, *Swallow*.

Shell inequilateral, transversely elongated, oblique, ovate, rhomboidal, gibbous from the beaks to the ventral posterior angle, flattened on the posterior slope, anterior and ventral margins regularly curved from the beaks to the posterior margin, ornamented with about twenty large concentric costæ or laminæ parallel with the ventral and posterior margins; cardinal margin nearly straight, forming with the posterior an obtuse angle; *beaks* prominent, approximate, recurved, inclined towards the anterior margin.

Length, 0.55; longest diameter from the beak to the posterior part of the ventral margin, 0.71; length of cardinal border, 0.42; thickness, 0.39.

Major Hawn's collection from the Lower Permian strata, near Council Grove, K. T.

CARDIOMORPHA KANSASENSIS, *Swallow*.

Shell elongate, ovate, oblique, gibbous from the beaks towards the posterior extremity, flattened near the posterior and ventral margins; ornamented with large, flattened, concentric costæ and small concentric and radiating striæ, rendering the surface finely tuberculated; regularly curved from the beak around the ventral margin to the posterior; cardinal margin nearly straight; *beaks* large, terminal, incurved, approximate.

Length, 1.83; height, 1.23; thickness, 1.05.

Major Hawn's collection from the Permian Rocks in the valley of the Cottonwood, K. T.

CARDINIA CORDATA, *Swallow*.

Shell oblong, inequilateral, ovato-cordate, sparingly convex, marked with regular prominent, concentric costæ; *beaks* large, pointed, incurved, inclined forward; presenting in profile a margin regularly convex from the beak to the posterior extremity of the ventral margin, and a concave border from the beak to the anterior margin, which is short and rounded; *ventral margin* convex and regularly curved; posterior margin obsolete.

Our specimens are casts, and show no surface markings.

Length, 0.92; breadth, 0.67; thickness, 0.38.

Major Hawn's collection from the Lower Permian Rocks, in the valley of the Cotton-wood, K. T.

CARDINIA (?) SUB-ANGULATA, *Swallow.*

Shell oblong, sub-oblique, inequilateral, sub-pentagonal, marked with strong, irregular, concentric ribs or plications, slightly convex, flattened towards the margins. *Beaks* large, prominent, incurved, inclined forward and approximate; a profile view gives a line slightly convex from the beak to the posterior margin, and a very concave line from the apex to the anterior margin; *cardinal border* nearly as long as the shell, and sub-rectilineal; *posterior ventral margin* convex, rounded at the anterior extremity and sub-angular at the posterior; *anterior margin* short, oblique, convex, forming a well-defined right angle with the cardinal border; posterior *extremity* oblique, sub-truncate.

Length, 0.83; greatest breadth, 0.58; thickness, 0.42.

Major Hawn's collection from the Lower Permian Rocks, in the valley of the Cotton-wood, K. T.

CARDINIA, species undetermined, but similar to *C. fascicularis Buvignier*, as given by *Pictet*, Tra. Pal., pl. LXXIX., fig. 7. It is like the

CARDINIA LISTERI (?), *Sowerby*, Min. Con., p. 123, pl. 154.

Our specimens are very similar to this fossil from the Lias of England; I should scarcely think of separating them if they were from the same formation. Specimens from England and Kansas together in my cabinet do not appear out of place.

PLEUROPHORUS (?) PERMIANUS, *Swallow.*

Shell elongate, inequilateral, gibbous, posterior end broad, angular at the extremity, anterior end short, contracting rapidly to the rounded extremity, flattened towards the anterior ventral angle; the cast shows the impressions of concentric laminæ and radiating costæ on the posterior cardinal slope, and a rounded ridge from the beaks to the ventral posterior angle. *Beaks* elevated, inclined forward near the anterior extremity; cardinal line appears oblique, two-thirds as long as the shell; posterior margin very oblique, slightly curved; ventral margin strongly curved at the ends, meeting the anterior and posterior slopes near the middle of the extremities.

Length, 1.55; greatest width near the posterior extremity, 0.87; thickness, 0.75.

Major Hawn's collection from the Upper Permian Rocks, near Smoky-Hill Fork, K. T., associated with *Monotis speluncaria*, *M. radialis*, and *Schizodus Rossicus.*

SCHIZODUS TRIANGULARIS, *Swallow.*

Shell small, sub-triangular, inequilateral, marked with fine, concentric striæ. Both *extremities* are acuminate and rounded at the points; the anterior a little broader and more rounded; *beaks* large, prominent, incurved, approximate, nearer the anterior extremity; *posterior cardinal slope* rounded, slightly less convex than the anterior; both sharply carinated; *ventral margin* arched, curve increasing about equally at each extremity.

Length, 0.49; width, 0.36; thickness, 0.21.

It most resembles the *Schlotheimi*, *Geinitz*, from the Upper Zechstein of Germany, and the Permian of England. The *triangularis* is more nearly equilateral, and is not truncated at the posterior extremity, and is more elongated.

Major Hawn's collection from the Lower Permian Rocks, associated with *P. Calhounianus*, *Cardinia subangulata*, on the waters of the Cotton-wood, K. T.

SCHIZODUS OBSCURUS, *Sowerby*, Min. Con., Vol. IV., p. 12, pl. 314.
SCHIZODUS OBSCURUS, *King*, Per. Fos. p. 189, pl. xv., figs. 23–24.

We have but one cast of this fossil. It is very similar to Sowerby's figures, and King's figure No. 23 is as much like our specimen as an engraving can well be made to the original. This fossil is found in many localities in the Permian Rocks of England and in the Lower Permian strata of Kansas with *Monotis Halli.*

SCHIZODUS ROSSICUS, *Verneuil*, Ge. Rus., Vol. II, p. 309, pl. xix., figs. 7–8.
SCHIZODUS ROTUNDATUS, *King*, Per. Fos., p. 190, pl. xv., fig. 30.
(?) AXINUS ROTUNDATUS, *Brown*, Man. Ge. Soc., Vol. I.

Our specimens are evidently identical with the *Rossicus* of Verneuil from the Permian Rocks of Russia, and there is scarcely a doubt of its identity with King's *rotundatus* from the Permian of England; but there is more doubt about Mr. Brown's *rotundatus*, which he says is smooth. All the other specimens are striated, including those from Kansas.

In the Upper Permian strata, near Smoky-Hill Fork, associated with *Nucula Kazanensis*, *Bakevellia antiqua* and *Mo-*

notis speluncaria. Our specimens present the varieties mentioned by M. Verneuil as occurring in Russia.

ALLORISMA LANCEOLATA, *Swallow.*

Shell elongate, lanceolate, with a well-defined, rounded ridge from the beaks to the ventral posterior angle, marked with large, regular, prominent, concentric costæ, strongly recurved toward the cardinal margin; it is also ornamented with nodular, concentric, and radiating striæ; the radiating striæ most obvious on the posterior extremity; *beaks* small, pointed, recurved forward to, or beyond, the anterior margin; *lunule* ovate, depressed.

Length, 1.30; width, 0.67; thickness, 0.42.

Major Hawn's collection from Permian Rocks in the valley of the Cotton-wood, K. T.

ALLORISMA (?) CURTA, *Swallow.*

Shell short, transverse, sub-rectangular, inequilateral, gibbous, broad at the anterior extremity and narrower at the posterior; marked with large, rounded, concentric costæ and small striæ, which are parallel to the costæ, and more prominent in the depressions between them; *beaks* large, depressed, approximate, sub-terminal; *anterior margin* rounded; *lunule* short, depressed, extending down the anterior slope; *cardinal margin* as long as the shell, straight.

Length, 0.97; width at beaks, 0.64; thickness, 0.56.

This species resembles the lata; but it is more gibbous, and the dorsal margin is not curved down towards the posterior extremity.

Major Hawn's collection from the Permian Rocks, near Council Grove, K. T.

ALLORISMA (?) MINNEHAHA, *Swallow.*

Shell elongate, inequilateral, trapezoidal, tumid, with a strong diagonal ridge from the beak towards the posterior ventral angle, where it becomes obsolete; marked with irregular longitudinal costæ and striæ, parallel to the ventral and posterior margins, forming an acute angle at the posterior extremity of the ventral margin; the *costæ* becoming narrower and more crowded and sometimes obsolete as they approach the cardinal margin; *posterior extremity* wide, tumid, gaping, obliquely truncate, and marked with fine, nodular, radiating striæ, nearly parallel to the diagonal ridges; *anterior extremity* short, narrow, rounded; *beaks* large, pointed, strongly incurved, approximate, nearly terminal; *lunule* ovate, depressed, extending down the anterior slope; escutcheon or suture nearly as long as the cardinal border, depressed, bounded by the obtuse ridges of the dorsal margin; *lunule* and *suture* divided by a longitudinal elevated ridge, in the cast; *valves* flattened towards the ventral margin where they meet at an obtuse angle, rounded and depressed on the dorsal border; *posterior margin* straight, oblique; *ventral* elongate, arched; *anterior* short, rounded; *dorsal* short, depressed, and strongly curved up at the posterior extremity; external ligament nearly as long as the cardinal border.

Dimensions of a large specimen:—Length, 2.31; greatest breadth at the posterior extremity of the cardinal border, 1.26; greatest thickness near the middle, 1.11; thickness at posterior extremity, 1.02.

Missouri State collection, from the Middle Coal Measures, near Lexington; and Major Hawn's collection from the Permian rocks, in the valley of the Cotton-wood, K. T.

LYRODON (*Myophoria?*) ORBICULARE (?), *Goldfuss*, pl. 135, fig. 10, p. 196.

Our specimen is a cast, and it agrees in size and form with the cast figured and described by Goldfuss from the Muschelkalk of Germany.

From No. 18 of the Triassic (?) System, K. T.

GASTEROPODA.

MURCHISONIA (?) KANSASENSIS, *Swallow.*

Shell elongated, with from eight to nine convex volutions; volutions marked with six nodular, spiral costæ.

Length, 0.19; diameter of anterior whorl, 0.07; spiral angle, 13°; sutural angle, 98°.

Collected by Major Hawn, in the valley of the Cotton-wood, K. T.

MURCHISONIA (?) PERVERSA, *Swallow.*

Shell minute, elongated, sinistrorsal, with from six to seven convex volutions which are marked with fine, spiral, nodular costæ.

Length, 0.12; diameter of anterior whorl, 0.06; spiral angle, 27°; sutural angle 59°.

From the valley of the Cotton-wood, K. T.

MURCHISONIA SUBANGULATA (?), *Verneuil*, Ge. Rus., p. 340, pl. XXII., fig. 6.

Our specimens are very imperfect, but they resemble this more than any other species.

From the Cellular Limestone of the Upper Permian strata, K. T.

LOXONEMA FASCIATA, *King*, Per. Fos., pl. XVI., fig. 30, p. 209.

Lower Permian strata, K. T.

MACROCHEILUS SPIRATUS, *McCoy*, Brit. Pal. Fos., p. 549, pl. 3H., figs. 1–2.

I am unable to see any specific distinctions between our specimens from the Lower Permian and that described and figured by McCoy, from the Carboniferous Limestone in Northumberland.

CEPHALOPODA.

NAUTILUS PERMIANUS, *Swallow*.

Shell of medium size, discoidal; *spire* formed of two or three rapidly increasing sub-hexagonal volutions; *dorsal margin* broad, flattened, slightly concave along the middle of some specimens; *sides* flattened; *interior lateral slopes* convex; *internal margin* concave, as modified by the succeeding whorl; *umbilicus* large, showing all the volutions; septa convex, sub-reniform, curved forward from the centre of the dorsal and ventral margins to the lateral, direct on the lateral; *siphuncle* large, sub-central, a little nearer the dorsal margin; *last chamber* large, enlarging rapidly toward the aperture, and becoming less angular; *aperture* transverse, reniform, slightly modified by the succeeding whorl. Surface markings not seen.

Diameter, 2.68; width of aperture, 2.25; length of aperture in middle, 1.64.

Major Hawn's collection from the Permian Rocks, near the Smoky-Hill Fork, K. T.

NAUTILUS OCCIDENTALIS, *Swallow*.

Shell of medium size, discoidal, tapering gradually, ornamented with six longitudinal rows of nodules, rendering the spire heptagonal; the two dorsal rows, separated by a deep concave channel, have each a large nodule on every chamber, one on the anterior and the other on the posterior side; those on the dorso-lateral angles have one nodule on every alternate chamber; the nodules around the umbilicus are smaller and less numerous. *Septa* very concave, periphery curved back on the dorsal and lateral margins, forming a rounded sinus in the dorsal channel, and a more obtuse curve on the flat lateral surfaces; *siphuncle* large, sub-central; *umbilicus* large; *aperture* small, sub-ovate.

Our specimens are imperfect casts of the last volution, from which we can not determine the surface markings or the number of volutions; but it may be easily identified by the arrangement of the nodules and septa.

Maj. Hawn's collection from the valley of the Cotton-wood, where it was associated with *Monotis Halli* and *Pecten Cleavelandicus.*

ORTHOCERAS KICKAPOOENSE, *Swallow.*

Shell elongate, conical, tapering gradually, sub-cylindrical, slightly flattened on the side next to the siphuncle; *septa* convex, distant less than one-third their smallest diameter; *periphery* sub-elliptical and slightly curved in the direction of the major axis; siphuncle small, eccentric, one-third of the diameter from the flattened side. Surface markings not seen.

Maj. Hawn's collection from the Upper Permian Rocks, near Smoky-Hill Fork.

CYRTOCERAS DORSATUM, *Swallow.*

Shell short, ventricose, conical, tapering rapidly toward the posterior extremity, strongly curved, depressed on the dorsal and ventral surfaces; last chamber large; *aperture* elliptical, dilated, somewhat irregular and corrugated on the inner margin; *siphuncle* cylindrical, touching the dorsal margin; *septa* convex, elliptical, oblique, distant on the dorsal margin less than one-third of the least diameter, approximate on the inner margin, periphery slightly sinuous, curved forward from the back to the sides and back on the sides. Surface markings not seen.

Major axis of the last septum, 1.26; minor axis, 1.01; distance between the last and penultimate septum on the outer margin, 0.31.

From the Permian Rocks of Kansas, near Smoky-Hill Fork, associated with *Nautilus Permianus* and *Spirorbis orbiculostoma.*

Descriptions of New Fossils *from the Coal Measures of Missouri and Kansas.*

BY B. F. SHUMARD AND G. C. SWALLOW.

Nautilus Missouriensis, *Swallow.*

Shell small, gibbous, smooth, somewhat flattened on the dorsal margin; *aperture* reniform, transverse, slightly modified by the preceding whorl; *septa* sparingly concave, margin curved a little forward towards the inner border of the shell; *siphuncle* sub-central, a little nearer the ventral margin; *umbilicus* deep, partially closed.

Diameter, 0.65;* thickness of last whorl, 0.54; diameter of last whorl, 0.38.

State collection, from the Hydraulic Limestone, near the base of the Coal Measures in Boone County, where it is associated with *Productus splendens*, *P. Wabashensis*, *Chonetes mesoloba*, *Spirifer cameratus*, *S. lineatus and Naticopsis Pricei.*

Nautilus planovolvis, *Shumard.*

Shell discoid, composed of about three gradually enlarging volutions, which are very slightly embracing; umbilicus very wide and moderately deep; sides flattened, declining very gently from umbilicus to dorsum, which is flat or very slightly convex; angle of junction between the sides and dorsum rounded, as is also the inner edge of the volutions; septa numerous, curving rather strongly backwards on the sides and dorsum; aperture sub-quadrate; surface markings not shown in any of the specimens in the collection.

This species is nearly related to *Nautilus trochlea* (McCoy), from which it is readily distinguished by its much narrower volutions.

Dimensions.—Length, 2.26; diameter of volution near aperture, 1 inch.

Upper Coal Measures, Missouri River, near Belleville, Nebraska Territory.

Collected by Prof. Swallow.

Nautilus nodoso-dorsatus, *Shumard.*

Of this species we possess merely fragments of the last vo-

* The measurements in this paper are in inches.

lution, which permit us to recognize only the following characters: Depressed discoidal; umbilicus wide, allowing all the volutions to be seen; septa rather thin, numerous, sinuate on the sides and gently arched backwards on the dorsum; sides flattened, rounded at the inner edge and obtusely subangulated on the dorsal edge; dorsum moderately convex, marked with three ranges of tolerably prominent nodules, one of the ranges being central, the others situated on the exterior edges.

Geol. Pos. and Loc.—Upper Coal Measures, Valley of Verdigris and Kansas Rivers, near Pottawattamie Reservation. Collected by Maj. F. Hawn.

GONIATITES POLITUS, *Shumard.*

Shell small, extremely thin, discoid, much compressed, polished; volutions embracing, the last one only visible; umbilicus very small; dorsum strongly rounded, smooth; sides gently and evenly convex, most prominent about the middle; aperture elongated, its margin very strongly sinuate on the sides and concave in front; surface marked with very obscure, strongly waved, transverse folds and minute striæ of growth, which are crossed by extremely fine, revolving, closely arranged striæ. The lobation of the chambers is not visible on any of the specimens before us.

Dimensions.—Length, .30; height, .21; thickness, .09; diameter of last volution at aperture, .14.

Geol. Pos. and Loc.—This little species occurs rather abundantly in the dark septaria of the Middle Coal Measures at Lexington, Missouri.

Collected by Prof. Swallow.

GONIATITES PARVUS, *Shumard.*

Shell small, discoid, moderately compressed; volutions embracing, the inner ones entirely hidden by the last; umbilicus very small, circular; dorsum strongly arched; sides gently convex; aperture longer than wide, margins sinuate; surface marked with a few, obscure, transverse folds, which are most distinct towards the aperture. Other surface markings and lobation of the chambers not visible in the specimen under examination.

This shell resembles the preceding species, but is not so much compressed.

Dimensions.—Length, .33; height, .23; thickness, .13; diameter of volution at aperture, .13.

Geol. Pos. and Loc.—Upper Coal Measures, Willow Spring, on Santa Fé road.

Collected by Maj. F. Hawn.

GONIATITES MINIMUS, *Shumard.*

Shell very small, discoid or sub-globose, thickness equal to about three-fourths of the length; *volutions* embracing, only the last one visible; *umbilicus* very minute; dorsum and sides strongly rounded; aperture semi-elliptical, its length and width nearly equal. The *surface* to the naked eye appears perfectly smooth, but when strongly magnified it is found to be thickly covered with extremely fine, transverse and revolving striæ, and near the umbilicus a few obscure folds.

This is the smallest species of *Goniatites* hitherto found in American strata. In young specimens the form is quite globose.

Dimensions.—Length, .12; thickness, 09.

Geol. Pos. and Loc.—Missouri State Collection obtained by Prof. Swallow from the Middle Coal Measures on the shores of the Missouri river above Dover's Landing. It occurs quite abundantly in dark septaria, associated with *G. planorbiformis*, *G. politus*, *Cardiomorpha Missouriana* and *Productus Boonensis.*

Collected by Prof. Swallow.

ORTHOCERAS ACULEATUM, *Swallow.*

Shell elongate-conical, particularly from the last septum to the aperture, tapering very gradually, flattened on the side most distant from the siphuncle; *septa* subelliptical, convex, distant from one-fifth to one-fourth of their diameter; *siphuncle* eccentric, small at the septa, enlarged in the chambers, as if made up of a succession of small hollow spheres, one occupying each chamber with a diameter equal to the distance between the septa; surface markings not seen.

Our shell resembles the *O. laterale* of Phillips, as described by M. D'Koninck (*An. Fos. p.* 508); it is however not fusiform towards the aperture, but rather more conical than in the other part, and the last chamber is not so large.

Maj. Hawn's collection from the Upper Coal Measures in the valley of the Kansas, K. T.

ORTHOCERAS MONILIFORME, *Swallow.*

Shell cylindrical, elongate, tapering gradually and somewhat irregularly, straight or curved, marked with broad, rounded annulations, which are separated by deep angular channels, the bottoms of which correspond with the periphery of the septa; the outer shell formed of several concentric laminæ; *septa* convex, distant one-fourth to one-third of their diameter, *periphery* of chambers convex; *siphuncle* large cylindrical, central, somewhat irregular in its development. Surface markings not seen. The general appearance of this shell is very much like the rattles of the rattle-snake.

Maj. Hawn's collection from the Coal Measures in the valley of the Verdigris, K. T.

ORTHOCERAS OCCIDENTALE, *Swallow.*

Shell slightly conical, flattened on the side next the siphuncle; septa convex, distant one-sixth to one-fifth their diameter, *periphery* elliptical, curved in the direction of the major axis; *siphuncle* small, sub-elliptical, eccentric, less than one-third of the diameter from the flattened side of the shell. Surface markings not seen.

Maj. Hawn's collection from Clifton Park, near the junction of the Coal Measures and the Permian Strata, K. T.

MACROCHEILUS MISSOURIENSIS, *Swallow.*

Shell oblong ovate; *spire* elongate, diminishing gradually, with six or more convex volutions; *aperture* wide, ovate, about half the length of the shell; *body whorl* short and large. *In the cast* the suture is impressed, the volutions angular, forming a spiral plane perpendicular to the axis on their posterior margins, which become much broader on the body whorl.

Length of shell, 1.75; thickness of body whorl, 0.98; spiral angle, 45°; sutural angle, 81°.

Missouri State Collection, from the Lower Coal Measures in Howard county.

MACROCHEILUS KANSASENSIS, *Swallow.*

Shell oblong-ovate; *spire* tapering gradually, with five or more regular convex volutions; *suture* impressed, ascending somewhat rapidly; *aperture* ovate, anterior end rounded, posterior acute, about half the length of the shell; *outer lip* regularly arched.

Length of shell, 1.45; thickness of body whorl, 0.65; length of aperture, 0.72; width of aperture, 0.45; spiral angle, 43°; sutural angle 85°.

This species resembles the *M. acutus, Sow.* The spire is longer, the spiral angle less, the sutural angle greater, the volutions fewer and less convex, and the aperture more elongated. In general appearance it more nearly resembles the *Paludina integra* of Say.

Our specimens are from the Upper Coal Measures of Missouri and Kansas. I am indebted to Maj. Hawn for a fine specimen from Willow Springs, K. T.

MACROCHEILUS PONDEROSUS, *Swallow.*

Shell thick, elliptical, ovate; *spire* short, tapering rapidly; *volutions* five to seven, convex, imbricate; *suture* slightly impressed; *aperture* oblong ovate, more than half the length of the shell; *columella* strongly plicated and thickened at the anterior extremity; *outer lip* acute, much arched; *body whorl* very large, twice as long as the spire, marked with very small obscure, transverse striæ.

Spiral angle, 72°; sutural angle, 65° to 70°; length of shell, 1.25; length of spire, 0.45; length of body whorl, 0.90; length of aperture, 0.80; breadth of body whorl, 0.85; length between the last and penultimate sutures on the side opposite to the aperture, 0.19.

This shell resembles the *Buccinum imbricatum* of Sowerby (Min. Con., Vol. II., pl. 566, fig. 2); *Macrocheilus imbricatus* of Phillips (Pal. Fos., pl. 39, fig. 194); but our shell is not so much elongated; its spire is shorter, spiral angle greater, and the markings are more obscure. It also differs from the *M. Spiratus*, McCoy, (Pal. Fos.) in having no concave space below the suture.

Maj. Hawn's collection from the Upper Coal Measures in the valley of the Verdigris, K. T.

TURBO OBESUS, *Shumard.*

Shell rotundate-ovate; spiral angle, 96°; *spire* depressed; *volutions* rapidly enlarging, evenly rounded, the last one inflated; *aperture* elongate-ovate; *surface* marked with equidistant revolving sub-nodulose rounded striæ, of which there are from seventeen to twenty on the body volution and which are preserved on the cast.

Dimensions.—Length, .64; width, .54; length of aperture, .44; width of same, .35.

Geol. Pos. and Loc.—Upper Coal Measures, near Iowa Point, Nebraska Territory.

Collected by Prof. Swallow.

NATICOPSIS (NERITA) PRICEI, *Shumard.*

Shell ovate, oblique, longer than wide; *spire* very much depressed, obtusely rounded at apex; *volutions* two and a half or three, convex, the last one very large, regularly and rather strongly ventricose in young specimens, but as the shell advances in age its upper portion becomes gradually flattened and sometimes strongly channelled towards the aperture, and at the same time it becomes more or less shouldered just beneath the suture; below the flattened portion it is still evenly rounded to the base; *suture* indistinct at the apex, but gradually becoming more deeply impressed as it approaches the aperture; aperture large, rotundato-quadrate, its height usually a little greater than the width, very oblique to the axis of the shell, contracted below near the columella; *lip* sharp, strengthened above at its juncture with the columella by the callosity of the latter; columellar lip thick, concave, callous, smooth; *surface* marked with numerous very fine lines of growth, and on the upper part of the volutions with rather strong plicistriæ, which curve obliquely forwards to the sutures. In some specimens the original coloring matter is still preserved, and the fossil presents a delicate vermilion hue.

Dimensions.—Spiral angle from 120° to 130°; length from apex to base of an average specimen, .85; greatest width, .82; height of aperture, .50; width of same 45°.

Geol. Pos. and Loc.—Missouri State collection, Upper Coal Measures, at a number of localities along the Missouri River and Hinkston Creek, Boone County. Maj. Hawn found it at various points in the valleys of Cotton-wood Creek and Verdigris River, K. T.

We are pleased to be able to dedicate this beautiful species to R. B. Price, Esq., of the Missouri Geol. Survey, to whose labors the State collection is indebted for a number of its most interesting fossils.

Murchisonia minima, *Swallow.*

Shell minute, turreted, elongate; volutions eight to ten, very convex, marked with from six to eight very prominent revolving striæ; *suture* deeply impressed; *aperture* oblique, semiorbicular, anterior margin contracted near the columella.

Length variable from 0.65 to 0.20; diameter of the last whorl, 0.02 to 0.08; spiral angle, 25°; sutural angle, 89°.

The *M. striatula*, D'Koninck (An. Fos. p. 415, pl. 40, fig. 7) is very nearly allied to this species; but the *minima* is not so large, has a less number of whorls and a much less spiral angle.

This minute fossil was first obtained in the Middle Coal Measures at Lexington, Mo., associated with *Bellerophon Meekianus*, *Chonetes mesoloba*, *C. Flemingii*, *Prod. muricatus*, etc. Maj. Hawn collected it on Turkey Creek, K. T.

Pleurotomaria sinistrorsa, *Swallow.*

Shell small, turreted, elongate, polished, often sinistral, with from four to five very convex volutions; marked on the central and anterior sides with about five distinct revolving striæ; striæ very indistinct or entirely obsolete on the posterior slope; *suture* deeply depressed; *aperture* orbicular.

Length, 0.26; thickness of last whorl, 0.14; spiral angle, 35°; sutural angle, 95°.

BELLEROPHON MEEKIANUS, *Swallow.*

Shell small, gibbous, broadly rounded on the dorsal margin, carinated near the aperture, ornamented with fine, crowded, longitudinal striæ and very minute transverse lines; *aperture* very much expanded, reniform, transverse, much modified by the preceding whorl; *lip* thickened and reflected over the umbilicus, with a linear callosity extending back from the points of junction on to the adjacent whorl; *volutions* concealed; umbilicus shallow, distinctly modified by the thick reflexed lip.

Diameter, 0.77; width of aperture, 0.60; length of aperture, 0.35.

This beautiful little shell resembles the *B. perlatus* of Conrad, (Jour. Acad. N. S. Phil., Vol. VIII., p. 270,) but his specimen has no transverse striæ, and ours is carinated only near the aperture. It is also similar to *B. Witryanus*, D'Koninck (An. Fos., pl. 28, fig. 9, p. 341); but the latter is easily distinguished by its very large umbilicus. *B. decussatus*, Fleming, (Phil. Ge. York., Vol. II., p. 231, pl. 17, fig. 13,) may be identified by the greater depth of the umbilicus and its well defined carina.

Missouri State collection from the Middle Coal Measures near Lexington; also by Mr. Price in the Lower Coal Measures in Howard County.

BELLEROPHON TRICARINATUS, *Shumard.*

Shell rather large, elongated, expanding rather gradually from beak to front; *aperture* elongate, sub-pentagonal; *dorsum* marked with three carinæ, which are rather strong towards the front and become obsolete posteriorly; central one most prominent, rounded; lateral ones broadest and sub-angular; *sides* descending obliquely from the carinæ to the base, flattened or slightly concave before and rounded posteriorly.

The specimen from which the description has been drawn is deprived of the test and no surface markings are preserved.

Geol. Pos. and Loc.—Upper Coal Measures, K. T.

Collected by Maj. Hawn.

BELLEROPHON KANSASENSIS, *Shumard.*

Shell of small size, sub-globose, very rapidly expanding at the front; *aperture* very transverse, short, reniform, the sides becoming much thickened, extended and gently recurved posteriorly, where the volution is covered by a smooth and thick callosity; *umbilicus* small, round, sometimes partially hidden by the thickening of the lip; surface ornamented with from twenty-two to twenty-four transverse, rounded ribs, which are gently arched forwards on either side of the dorsal sinus and become nearly obsolete before reaching the umbilicus; these are decussated on each side of the sinus by from ten to twelve revolving thread-like lines, distinct on the dorsum, but becoming indistinct towards the umbilicus; at the points of intersection of the transverse and revolving lines there is a thickening which gives to the surface a very beautiful sub-granulose appearance; *dorsal band* narrow, rather strongly depressed anteriorly, becoming shallow posteriorly, bounded on either side by a thread-like line, and marked by the transverse furrows, which are arched backwards.

Dimensions.—Length, .44; height, .32; width of aperture, .40; length of same, about .19.

There is in the collection a specimen which is double the size of that from which the above proportions were taken.

Geol. Pos. and Loc.—This is one of the most beautiful species of our Western Coal Measures. It was obtained by Maj. Hawn from the valley of Verdigris River, K. T.

CAPULUS PARVUS, *Swallow.*

Shell small, oblique, obsoletely carinated on the left anterior and right posterior slopes; sub-erect, elongate, conic; apex obliquely recurved, acute, prominent; *aperture* sub-regular, rotundato-ovate, sinuate on the anterior and posterior margins; surface ornamented with fine, irregular, undulating, concentric striæ, curved towards the apex on the anterior and posterior slopes, very regular and direct near the apex.

Length from apex to anterior margin, 0.30; height, 0.23; transverse diameter of aperture, 0.09.

Maj. Hawn's collection from the Coal Measures in the valley of the Verdigris, K. T.

CAPULUS TRIPLICATUS, *Swallow.*

Shell very oblique, depressed, elongate-conic; *apex* scarcely incurved, blunt; *aperture* elongate, irregularly ovate, sinuate on the anterior margin; *anterior slope* occupied by three broad, depressed plications. Surface markings not seen, as our specimen is a cast only.

Length, 1.09; height, 0.25; width of aperture, 0.69; length of aperture, 0.92.

Maj. Hawn's collection from Coal Measures near Bull Creek, Santa Fé Road, K. T.

CYPRICARDIA PLICATULA, *Swallow.*

Shell transverse, gibbous, inequilateral, sub-rhomboidal, strongly marked with prominent concentric laminæ, which rise abruptly from the smooth, even surface of the shell, leaving the space between them flat and smooth; *beaks* prominent, sub-anterior recurved, inclining forward, distant; *lunule* deep, elongate-cordate; *lips* of escutcheon very prominent; *margins* arcuate, posterior sub-angular.

Dimensions of a large specimen.—Length, 0.77; height from beak to opposite margin, 0.64; thickness, 0.44. Dimensions of small specimen—length, 0.37; height, 0.29; thickness, 0.20.

Our fossil is very similar to *Venus parallela*, Phil. (Ge. York. pl. v., fig. 8), but his description says the shell is "delicately furrowed." D'Koninck's *Cypricardia parallela* (Anim. Fos., pl. iii., fig. 15) referred to Phillips species doubtfully, also differs in the markings. His is "*tenuissime striata.*"

Collected by Maj. Hawn in K. T., No. 98 of his general section. Missouri State collection from Lower Coal Measures, Howard County, and Middle Coal Measures, Platte County.

ISOCARDIA (?) CURTA, *Shumard.*

Shell small, sub-quadrate, gibbous, length and height about equal; *cardinal margin* short, gently rounded; *posterior border* obliquely subtruncate, gently rounded and forming an obtuse angle with the palleal border, which is slightly arcuate; *buccal margin* descending with a strong curve to the base; *umbones* convex, gibbous, greatest gibbosity between the middle of the valves and the beaks; *beaks* elevated above the cardinal line, strongly incurved, situated about one-third the length of the shell from the anterior extremity.

The specimens in the collection are all destitute of the test. The mould exhibits obscure concentric folds running parallel with the borders.

Dimensions.—Height, .44; length, .46; thickness, .30; apicial angle, about 85°.

Geol. Pos. and Loc.—Coal Measures, Charbonniere, St. Louis County, Missouri. Missouri State collection.

CARDIUM (?) LEXINGTONENSIS, *Swallow.*

Shell small, polished, ovate, oblique, inequilateral; *anterior* and *ventral margins* forming a very perfect semicircle; *posterior slope* but slightly arched, marked with irregular, unequal, concentric rugæ, and fine striæ and fine radiating costæ, which are more prominent near the anterior slope, where the shell is most gibbous; *beaks* small, nearly terminal, slightly incurved; *posterior slope* longitudinally striate, striæ slightly diverging from the center.

Length, 0.35; breadth from beak to ventral margin, 0.32; thickness, 0.22.

POTERIOCRINUS RUGOSUS, *Shumard.*

The *calyx* of this beautiful Poteriocrinus is depressed, sub-hemispherical and its under surface broadly excavated. The *surface* is generally thickly studded with short rugæ, strong and irregularly disposed, but sometimes with granulæ.

The *base* is rather small, pentagonal, concave, and profoundly excavated in the middle. The pieces are rhombic, recurved, and their lateral edges much the longest. The *columnar facet* is circular, occupies about one-half the diameter of the base, and is situated at the bottom of a deep excavation. The central perforation is small and pentalobate. In the interior of the calyx the base forms a strong mammillary swelling.

The *sub-radial pieces* are rather thick, longitudinally recurved, and slightly wider than long. Four of them are pentagonal, with basal and infero-lateral edges about equal, and superior edges very slightly arched. The fifth piece is hexagonal and its superior edge very short.

The 1*st radial pieces* are very thick, transverse; inferior edges very slightly concave, and more than double the length of the lateral edges. The superior edge is nearly straight, bevelled outwards, the articular facet well developed, and marked similar to that of the preceding species, though it is much narrower.

2*d Radial pieces.*—There is in the Missouri collection a single 2d radial piece from Putnam County, which apparently appertains to this species. It is short, very thick, pentagonal and an axillary piece. The articular facets are broad, strongly marked, and their edges strongly crenulated.

Anal pieces.—The principal anal piece only remains attached to the calyx. It is very small, elongate-pentagonal, and wedged in between the lateral edges of two of the 1st radials, projecting above the plane of their superior edges.

Dimensions.—Height of calyx, .32; diameter, .92; diameter of base, .25; height of sub-radials, .19; height of 1st radials, .28.

Geol. Pos. and Loc.—This elegant Poteriocrinus was found by Prof. Swallow in the Coal Measures of the bluffs of the Missouri River, and in the same geological position in Putnam County near Black-Bird Creek. It appertains to the same group of the genus *Poteriocrinus* as the preceding species.

ARCHÆOCIDARIS ACULEATUS, *Shumard.*

Of this handsome species of Archæocidaris, we have, merely, specimens of the interambulacral plates and some of the primary spines.

The *interambulacral plates* are thin, irregularly hexagonal, which, however, never attains the extraordinary thickness of the American shell, nor do we find in our specimens the "irregular interruption and undulation of the concentric wrinkles in front of the middle" mentioned by McCoy (British Palæozoic Fossils in Mus. Univ. Camb., p. 508).

Dimensions.—A very gibbous variety gives the following proportions: Length, 2.08; height, 1.33; thickness, 1.21. A compressed variety gives: Length, 1.84; height, 1.04; thickness, .78.

Geol. Pos. and Loc.—This fine speeies is from the Upper Coal Measures of the valley of Verdigris River, K. T.

Collected by Maj. F. Hawn.

LEPTODOMUS TOPEKAENSIS, *Shumard.*

Shell ovate, sub-quadrate, length less than double the height; anterior margin descending obliquely from the beaks, strongly rounded below; *anal margin* oblique, subtruncate; *palleal margin* gently arcuate; cardinal edge straight, bordered with a slightly prominent carina; *umbones* moderately gibbous, obtusely subangulated posteriorly, strongly rounded in front, most gibbous a short distance below the beaks, a slight depression anteriorly extending obliquely from beak to base; *posterior slope* compressed, smooth, separated from the prominent portion of the valves by a distinct but shallow linear sinus; *beaks* large, incurved, considerably elevated above the cardinal edge, sub-angulated before and behind, located near the front; *surface* marked with irregular, rounded, concentric folds, which are gently waved at the slight anterior depression and become obsolete on the anterior slope, posteriorly they die out before reaching the linear sinus at the inner edge of the umbonial slope.

This shell resembles in some respects *Cypricardia occidentalis* (Hall), but the outline is quite different.

Dimensions.—Length, 1.40; height, .80; thickness, .61.

Geol. Pos. and Loc.—Missouri State collection. Occurs in the Coal Measures of the bluffs of Missouri River, a short distance below the mouth of Kansas River.

SOLEMYA (?) RECURVATA, *Swallow.*

Shell corneous, thick, elongate, inequilateral, gibbous; *beaks* large rounded, depressed, approximate; *anterior extremity* narrow rounded, one-third the length of the shell; *posterior extremity* wide, obliquely truncate, gaping; *cardinal border* long, curved up at the posterior extremity; *ventral margin* regularly curved from the anterior extremity to the ventral posterior angle; *posterior margin* long, oblique, slightly convex; *valves* convex, flattened towards the ventral margin, where they meet at an acute angle; *lunule* depressed, extending down the anterior slope, showing the remains of an external ligament; *escutcheon* depressed, sustaining an elevated, transversely rugose ligament; *surface markings* not very distinct in our specimens, but sufficiently so to indicate irregular, sub-imbricating laminæ and fine striæ parallel to the anterior, ventral and posterior margins.

Length, 2.18; greatest width near the posterior extremity, 1.16; greatest thickness a little back of the beaks, 0.85.

Maj. Hawn's collection, from near the junction of the Coal Measures and Permian Rocks in Clifton Park, K. T.

ARCA CUSPIDATA, *Swallow.*

Shell rhomboidal, inequilateral, subequivalve; *beaks* prominent, strongly incurved, inclined forward near the anterior extremity; *valves* gibbous towards the anterior extremity, with angular or rounded ridges from the beaks to the anterior and posterior ventral angles, the space between full and convex; the posterior ridge more prominent in the left valve, while the anterior is more so in the right of some specimens; *anterior margin* forming an acute angle with the straight cardinal margin; *surface* marked with large, rounded, concentric costæ. Surface markings not seen, as our specimens show the cast only.

Length, 1.25; breadth, 1.19; thickness, 0.91.

Maj. Hawn's collection, from the Upper Coal Measures near Burlingame, K. T.

EDMONDIA HAWNII, *Swallow.*

Shell subquadrate; angular at the junctions of the lateral and terminal margins, inequilateral; gibbous on the line from the beak to the ventral posterior angle; flattened on the slope towards the posterior cardinal angle; ornamented with very prominent concentric, subimbricated laminæ, whose edges are sometimes finely crenulated. *Cardinal border* nearly straight; *beaks* prominent, incurved, inclined forward, approximate, nearly terminal; *anterior margin* shorter than the posterior.

This shell is sometimes sub-rhomboidal, narrower at the posterior extremity, and marked with a few irregular costæ between the laminæ.

Maj. Hawn's collection from the Coal Measures near the Sac and Fox Agency and in several other localities in K. T.

Our shell resembles the *E. unioniformis*, Phillips. (Ge. York. Vol. II., pl. v., fig. 18, and D. K., An. Fos., pl. I., fig. 4,) but it is decidedly more quadrate, and I have seen no specimen "tenue stratis abducta." It also differs from E. *Josepha*, D. K. (An. Fos., pl. I. fig. 5), in form and surface markings. It also differs from *E. rudis*, McCoy, (Brit. Pa. Fos, pl. 3, fig. 9,) in having the anterior and posterior slopes plicated, and not "nearly smooth."

I take pleasure in dedicating this shell to Maj. Hawn, the indefatigable discoverer of the Permian System in Kansas Territory.

ALLORISMA CUNEATA, *Swallow.*

Shell elongate, cuneate, thick and narrow at the anterior extremity, broad and thin at the posterior; obliquely gibbous from the beaks to the posterior extremity, ornamented with concentric ribs and striæ, which form a sharp curve near the posterior extremity of the shell; *ventral margin* defined by a regularly increasing curve from the beaks to the posterior extremity; anterior half of *cardinal margin* straight, the remainder curved towards the ventral; posterior extremity subangular; beaks prominent, pointed, approximate, and terminal.

Length, 1.73; greatest breadth, 0.89; thickness, 0.61.

This shell differs from all other specimens of the genus by its cuneate form, and very pointed terminal beaks.

Missouri State collection from Middle Coal Measures near Lexington.

ALLORISMA LATA, *Swallow.*

Shell elongate, subovate, narrowed and flattened towards the posterior extremity; *anterior extremity* rounded, marked with concentric ribs and striæ; ribs unequal and large; striæ most distinct between the ribs; *beaks* small, incurved, approximate and nearly terminal; ventral and cardinal margins about equally curved towards the posterior extremity.

Length, 1.64; greatest breadth about the middle of the shell, 1.04; greatest thickness near the beaks, 0.68.

This shell is distinguished by its great breadth.

Missouri State collection, from the Middle Coal Measures near Lexington.

AVICULA SEMIELLIPTICA, *Shumard.*

Left valve semielliptical, moderately oblique, depressed convex, height greater than the length, greatest length near the cardinal margin, which is straight and forms with the buccal margin an angle of about 80°; buccal margin slightly arcuate; posterior and inferior margins rounded; anterior wing large, rounded at extremity, not well defined from the body of the shell; *umbones* depressed convex; *beaks* small, pointed, scarcely elevated above the cardinal margin, and situated rather behind the middle of it; *surface* beautifully ornamented with very fine, crowded, waved lines, which are crossed by numerous irregular, flexuous, slightly prominent, radiating striæ.

Dimensions.—A young and nearly perfect specimen gives for height, .32; and for the length, .26.

Geol. Pos. and Loc.—Found by Maj. F. Hawn in the Upper Coal Measures of the valley of the Verdigris River, K. T.

AVICULA SHAWNEENSIS, *Shumard.*

Shell very inequilateral, subtrigonal, linguæform, oblique, curved, height much greater than the length; buccal and palleal margins, forming together a long, moderate curve from the cardinal edge to the posterior inferior extremity, which terminates in an acute angle; anal margin deeply concave; *umbonial region* rather elevated, moderately convex, most prominent near the beak, posteriorly angulated, subcarinate, and the slope abrupt; *beak* passing beyond the cardinal margin and situated nearest the anterior extremity; posterior wing large, triangular, its cardinal edge straight, extremity pointed. The surface markings are not well preserved on any of the specimens under examination; we can only detect fine concentric striæ of growth on some fragments.

Dimensions.—From beak to posterior inferior extremity, .66; thickness of left valve, .13; length of cardinal margin, .44.

Geol. Pos. and Loc.—Discovered by Major Hawn at Clifton Park, Kansas Ter., in Upper Coal Measures.

MYTILUS OTTAWAENSIS, *Shumard.*

Shell very inequilateral, sub-trigonal, linguæform, oblique, length rather more than double the height, very gibbous, greatest prominence near the beaks; cardinal and anal margins forming a strong curve from cardinal to posterior extremity, which is sharply rounded; buccal margin very short; palleal margin long and gently concave or sinuate; umbonial region strongly convex, abruptly deflected inferiorly to the palleal border; *surface* marked with very fine, crowded, concentric striæ and coarser lines, indicating the successive stages of growth.

Dimensions.—Length, .84; height, .42; thickness, .42.

Geol. Pos. and Loc.—Upper Coal Measures.

Collected by Major Hawn from the valley of the Verdigris River. Only one specimen is contained in the collection.

MYTILUS TENUIRADIATUS, *Shumard.*

Shell very inequilateral, thin, much elongated, greatest height about the middle, valves convex; superior and posterior margins forming a long, regular and gentle curve to the extremity, which is rounded; buccal margin very short, rounded; palleal margin straight, or very slightly sinuate; umbonial region convex, moderately gibbous, greatest convexity about one-third the distance from beak to posterior extremity, declining gently from the prominent portion to the posterior extremity, and somewhat abruptly to the superior and inferior edges; *beaks* small, very slightly elevated, situated a short distance from the extremity; *surface* marked with numerous, fine, concentric striæ, crossed by very delicate, closely approximate, curved, radiating striæ.

Dimensions.—Length, .78; height, .27; thickness, .18.

This species is very analagous to *Mytilus Pallasi Verneuil*, (*Geol. Russ.*, *p.* 316, *pl. XIX.*, *fig. a—k*), from the Permian System of Russia, but it is separated by its greater proportionate height, and the shortness of its buccal edge. When the surface markings are preserved, our shell is at once distinguished by its numerous, filiform, radiating striæ; the Russian species, according to M. de Verneuil, being marked only occasionally with three or four.

Geol. Pos. and Loc.—Upper Coal Measures.

Collected by Major Hawn from valley of Verdigris River, K. T.

MYALINA RECTA, *Shumard.*

Shell ovate, sub-trigonal, thin; in young specimens the buccal and anal borders are sometimes nearly sub-parallel, but in mature age the latter is more or less strongly arched; *buccal border* usually very straight from beak to base; *cardinal margin* oblique, straight or very slightly arcuate, forming with the posterior border a very obtuse angle; *palleal border* strongly rounded; *umbones* angulated, and most prominent at the anterior edge, where the valves are abruptly inflected, forming an acute angle with the plane of the body of the shell, which slopes gently to the anal and palleal borders; *beaks* terminal, pointed, straight; *surface* marked with thin, imbricating lamellæ, which in some specimens are crossed by fine, indistinct, radiating striæ.

We have not been able to see the hinge and other internal characters of this species, but it possesses the form of *Myalina*, and we therefore refer it to that genus. The *Mytilus squamosus* of King, from the Permian of England, which is also probably a Myalina, resembles our fossil; but the characters above given will enable the student to distinguish readily the one from the other.

Dimensions.—Height, 2 inches; length, 1 inch; thickness, .60.

Geol. Pos. and Loc.—This species was found by Maj. Hawn in the Permian strata in Clifton Park, K. T.

MYALINA KANSASENSIS, *Shumard.*

Shell sub-rhomboidal, sub-inequivalve, inequilateral, gibbous, the left valve more gibbous than the right; height about double the length; in young specimens the greatest length is at the cardinal border, but in the adult towards the palleal margin; *cardinal margin* oblique, slightly arched, and forming with the posterior border an angle of about 120°; *posterior margin* rather strongly arched in adult specimens, and very gently rounded in the young; *palleal margin* rounded; *buccal margin* concave; *umbones* very prominent anteriorly, and declining with a moderate slope to the posterior margin; anterior slope very abrupt; *beaks* terminal, attenuated, directed obliquely forward, incurved; *surface* with strong, imbricating, sub-equidistant, concentric lamellæ, whose free edges are often irregularly crenate, lamellæ most prominent on the left valve.

The ligament facet is broad, and marked with equi-distant, close, deeply impressed lines, parallel to the cardinal edge, the number varying with the age of the shell; beneath these is a rather broad, smooth space, which is continuous with a similar space extending from the palleal region. Each valve exhibits a single muscular impression, which is large, ovate, and situated towards the posterior margin.

Dimensions.—Height, $2\frac{1}{3}$ inches; length, 1.17; thickness, .88.

This species is distinguished from *M. subquadrata* (nobis) by its smaller size, greater proportionate height, more slender beaks, and stronger and crenate lamellæ.

Geol. Pos. and Loc.—Major Hawn collected this fine species from the upper division of the Coal Measures, on the Santa Fé road, south of Lecompton; nine miles south-west of Council Grove; at the Sac and Fox Agency; on the head waters of Osage River; and from the valley of Verdigris River, K. T. Prof. Swallow found it occupying the same geological position in the Bluffs of the Missouri below the mouth of Platte River, Nebraska Ter.

PECTEN AVICULATUS, *Swallow.*

Shell rather large, sub-orbicular, slightly convex in the centre; wings very small, outer margins forming an obtuse angle with the cardinal line, separated from the shell by depressed lines, no sinus between them and the sides of the shell; below the wings, are wide, flattened, wing-like appendages extending down the sides more than half the height of the shell, leaving the inflated part of the left valve broadly ovato-cuneate; *surface* ornamented with fine, concentric and radiating striæ, and lines of growth which are most distinct near the beak and ventral margin; *beak* very small, depressed, pointed.

Length of cardinal line, 0.60; greatest breadth of shell, 1.56; height from beak to base, 1.58.

Major Hawn's collection from the Coal Measures in the valley of the Verdigris, K. T.

PINNA PERACUTA, *Shumard.*

Of this shell the collection contains nothing more than fragments of the anterior portion, which do not permit us to give more than a very partial description of the species.

The *shell* is very thin, conico-triangular, very gradually tapering from the beak posteriorly, where (judging from the lines of growth) it is strongly rounded; the *beak* is acute and tapering; *umbones* most prominent above the middle, gently rounded above the gibbosity and flattened below to the palleal margin.

Geol. Pos. and Loc.—Occurs in the Upper Coal Measures of the Missouri River, near Iowa Point, where it was found by Prof. Swallow. Major Hawn also found it in the same geological position at several localities in Kansas Ter.

LIMA RETIFERA, *Shumard.*

Shell inequilateral, rather small, sub-ovate, oblique, somewhat compressed, convex, height greater than the width; *cardinal margin* short, straight, forming with the buccal margin rather more than a right angle; *buccal* and *palleal margins* rounded; *anal margin* oblique, slightly concave; posterior umbonial slope falling rather abruptly to the ear, which is obtusely angulated, rather small and slightly recurved; anterior ear small, not ribbed, triangular, its cardinal border incurved; *beak* small, obtusely pointed, passing beyond the cardial edge, and situated a little in advance of the middle of the same; *surface* of left valve marked with fine, concentric striæ, and about twenty-five distinct, angulated, sub-equidistant, radiating ribs, which usually bifurcate anteriorly, and are simple behind; on the anterior umbonial slope the ribs are indistinct, and on the posterior entirely wanting.

Dimensions.—Height of left valve, .64; length of same, .54; thickness of same, .12; length of cardinal edge, .25.

This shell possesses all the external characters of *Lima*, to which genus we unhesitatingly refer it, believing that the internal characters when seen will confirm this opinion. Hitherto no example of this genus has been found so low down in the geological series. Prof. King cites a single species (*Lima Permiana*) from the Permian rocks of England; all other known species are from Secondary rocks.

Geol. Pos. and Loc.—Collected by Major F. Hawn from the Coal Measures of the valley of the Verdigris River. It is there associated with *Productus Nebrascensis* and *Fusulina cylindrica.*

BRACHIOPODA.

LINGULA CARBONARIA, *Shumard.*

Shell elliptico-subquadrate, length nearly one-third greater than the width, a broad, very slightly raised elevation extending from the beak towards the front, obscurely channelled in the middle and becoming obsolete before reaching the front; *lateral edges* sub-parallel, forming with the cardinal margin a continuous curve from beak to palleal margin, the curve being somewhat stronger at the extremities; *palleal margin* truncate or very gently arched; *beak* very slightly elevated, obtusely rounded; *surface* polished and marked with delicate, concentric lines of growth, and fine, rather indistinct, radiating striæ, which are not apparent on all specimens.

The shell of this species is exceedingly thin, and the valves appear to be very flat on the surface of the shale in which they are embedded, though this may be in part due to compression.

Dimensions.—Length, .42; width, .28.

The *Lingula carbonaria* bears a strong resemblance to *L. squamiformis* and *L. parallela* of Phillips. From the first it is distinguished by being rounded retrally instead of acuminate, while the second has no radiating striæ, which are plainly visible in our species.

Geol. Pos. and Loc.—Occurs very abundantly in dark shale of the Coal Measures in Clark County, Missouri, associated with ferns and other coal plants.

PRODUCTUS CALHOUNIANUS, *Swallow.*

Shell large, sub-hemispherical, sinus narrow, extending from the visceral region to the anterior border of the dorsal valve; *beak* small, recurved beyond and within the cardinal border; *ears* large, triangular, strongly arched, curving towards the cardinal border, ornamented with numerous tubular spines, those on the cardinal border somewhat regularly arranged in parallel rows; *cardinal border* as long as the greatest width of the shell, the extremities somewhat reflexed towards the visceral region of the dorsal valve; *dorsal valve* regularly arched, with a curve constantly increasing from the anterior border to the beak, ornamented with numerous, somewhat irregular, longitudinal costæ, narrow and prominent towards the beak, but broader and more flattened towards the anterior margin, their number increased by insertion and subdivision; the whole surface ornamented with tubular spines, which are more

besides, the latter has fenestrules nearly double as wide as the interstices, being at the same time strongly corticated, at least on the reverse.

It resembles the *F. antiqua* (*Gold sp. McCoy*), but differs by the thickness of its interstices, as well as by the greater length and fewer number of fenestrules in a given space.

Locality.—Permian White Limestone, Guadalupe Mountain, New Mexico.

FENESTELLA CORTICATA. (*Prout.*)

Corrallum wide, long fan-shaped; bifurcations few, caused by the mere insertion of a middle line of fenestrules; length unknown—that of the specimen at least two inches.

Longitudinal rays or interstices large, only about one-third less than the fenestrules, tubular-striate where worn, the striæ expanding as they ascend between each oscule, from one dissepiment to another, about seven to two lines.

Dissepiments short, stout, expanding at junction with rays, seeming to surround them, non-poriferous; seven in the space of two lines.

Fenestrules nearly as wide as long where worn down, presenting hollow squares with thin sharp edges; where well preserved with the cortex investing them, they are nearly oval; sbout six transversely, or longitudinally.

Cell pores indistinct, but sufficiently marked to show three large cells to each fenestrule, or five counting the two which belong to the dissepiments above and below.

Reverse distinctly corticated, the surface showing an irregular line of tubercles upon each ray, with scattered pores.

This description is drawn from a specimen which is much weathered, but by careful observation we trust we have been able to define its relations:—It bears an analogy to the *F. patula* (*McCoy*), and the *F. antiqua* (*Gold. sp. ib.*), but differs in the same relations as the *F. Popeana.* It may, indeed, be only a variety of the latter; but, from its fan-shaped expansion, the greater length of its bifurcations, the smaller size of its fenestrules, and the wider separation of its pores transversely on the two sides of the longitudinal rays, we are inclined to believe that better preserved specimens will enable us to establish a specific difference. The *F. corticata* and *F. Popeana* both resemble the *Retepora* (*F.*) *tenuifilia* and *R.* (*F.*) *flabellata*, *Phillips*, but his descriptions are so meagre that it would be difficult to determine fully their analogies or differences. Both of the latter seem to be keeled, and their dissepiments are represented, both in the text and plates, as being thinner than in our two species.

Locality.—Collected by Dr. Geo. G. Shumard from the Carboniferous Limestone of the Organ Mountains.

PRODUCTUS BOONENSIS, *Swallow*.

Shell small, elevated, sub-hemispherical, without a mesial sinus, ornamented with fine, regular, rounded, longitudinal costæ, and larger, irregular, concentric rugæ, and small, tubular spines; the rugæ which pass over the visceral region and down across the ears, are the largest and most regular; the spines are more or less regularly arranged in diagonal lines and quincunxes; they are most numerous on the margins and ears; the ventral valve is marked with small pits instead of the convex bases of the spines on the dorsal; *cardinal margin* slightly curved, as long or longer than the width of the shell; *dorsal valve* very gibbous, often varying from hemispherical to oblique conical, strongly and regularly arched; slopes from the visceral region to the ears very abrupt; *beaks* prominent, strongly incurved, scarcely passing beyond the cardinal line; *ears* large, flattened, strongly corrugated, with about seven rugæ perpendicular to the cardinal margin, each fold sustaining one or more spines, arranged in lines parallel to the cardinal margin; outer angle usually sub-acute, with a slight sinus between them and the lateral margins. *Ventral valve* semi-orbicular, very concave, regularly arched; ears separated from the visceral region by well-defined ridges.

VAR. ELEVATA, P. BOONENSIS, more elevated; *beak* much more elongated and strongly recurved; *spines* less numerous, but more regularly arranged in diagonal lines. This variety very nearly resembles the *P. spinulosus*, Sow.

Typical Specimen.—Length, 0.56; breadth, 0.62; height of dorsal valve, 0.33.

Var. elevata.—Length, 0.54; breadth, 0.44; height of dorsal valve, 0.33; length of cardinal border, 0.51.

The *P. Boonensis* may be distinguishsd from the *P. spinulosus* of Sowerby by the larger ears, longer cardinal border and more distinct concentric rugæ; from the *P. undiferus*, which it most resembles, by the marks of spines on the ventral valve and the more distinct concentric rugæ.

Missouri State collection from numerous localities in the Coal Measures, particularly the upper divisions near the mouth of the Platte, in N. T. Maj. Hawn's collection from the Coal Measures in K. T.

PRODUCTUS COSTATOIDES, *Swallow*.

Shell small, transverse, sub-rectangular; *cardinal border* longer than the width of the shell; *beak* small, recurved scarcely beyond the cardinal border; *ears* large, thin, vaulted and reflexed; *dorsal valve* elevated, somewhat regularly arch-and bear a small, prominent, primary tubercle, which is deeply perforated, and situated on an elevated, smooth boss, from the border of which it is separated by a deep, circular canal. Around the base of this boss is a broad, circular areola, the inner semi-diameter of which is a slightly raised ring nearly plane, while the exterior portion is concave and marked with very obscure, radiating rugæ. The areola is margined by a ring of closely-set secondary tubercles, arranged in a single line. Exterior to this ring the surface is thickly studded on the ambulacral side with fine granulæ and secondary tubercles. The primary spines are elongate-fusiform, very variable in length and rather strongly curved at their bases. Some specimens are also slightly curved near the apex, the curvature being in an opposite direction to that of the base. The transverse section in most specimens is multangular, but sometimes it appears to be nearly circular. The ring at the base is small, finely milled on the edge, and set oblique to the axis of the spine. The surface is very finely striated longitudinally and thickly studded with short spines, whose apices are directed obliquely upwards. They are arranged on the angles of the principal spines in from eight to twelve longitudinal rows.

Dimensions.—The primary spines vary from one to two inches in length, and their greatest diameter from .10 to .14 of an inch.

Geol. Pos. and Loc.—This species was collected by Maj. Hawn from the Upper Coal Measures, at variou spoints along the valley of Verdigris River, on the Santa Fé road near Rock Creek, and 25 miles west of Council Grove in the valley of Cotton-wood Creek. Dr. George G. Shumard found it abundantly in the Coal Measures near Fort Belknap, Texas. At all of these localities it is associated with *Fusulina cylindrica* and *Spirifer cameratus.*

ARCHÆOCIDARIS BIANGULATUS, *Shumard.*

The *interambulacral plates* of this species may, at the first glance, be readily mistaken for those of *Archæocidaris aculeatus.* The principal differences exist in the areolar surface, which is covered with very minute, radiating striæ, and is subhexagonal instead of circular. The inner ring of the areola is also narrower and much more prominent, while the outer ring does not exhibit any traces of rugæ.

The primary spines are very long, slender, and the surface is covered with exceedingly fine, crowded, longitudinal striæ, which are scarcely visible to the naked eye. Just above the expanded portion of the base the spines are cylindrical, but they soon become much flattened and their exterior edges acutely angulated. The edges are garnished on either side

ORTHISINA MISSOURIENSIS, *Swallow.*

Shell somewhat irregular, variable, transverse, sub-orbicular, gibbous; *dorsal valve* sub-conical, highest at the beak, slightly convex, but usually depressed near the center; *beak* long pointed, semi-conical, usually inclined towards one of the extremities of the cardinal border; *area* large, deltoid, sub-vertical, decussate; *aperture* narrow, linear, or contracted towards the summit, extending from the base of the area to the summit; *deltidium* convex, closing the aperture, sometimes slightly deltoid, pointed at the apex, marked with transverse rugæ. *Ventral valve* convex, very gibbous, recurved near the beak, slightly flattened towards the anterior margin; *area* obsolete; *beak* small, in contact with the deltidium. *Each valve* is marked with obscure, concentric rugæ or lines of growth, and from ten to fourteen large, strongly carinated, radiating ribs, which become depressed and smaller in the middle and obsolete near the beaks; the surface is also ornamented with longitudinal and concentric striæ; *longitudinal striæ* large, nodular, increased by insertion, regular towards the beaks, but irregular on the angular costæ, where they usually pass from the summit of each diagonally back to the bottom of the channel; the *transverse* striæ are smaller, more obvious between the longitudinal lines, concentric towards the beaks; but on the ribs they cross the other set of striæ nearly at right angles. The longitudinal striæ are themselves sometimes marked with very fine nodular lines or by rows of minute papillæ.

Length of a small specimen, dorsal valve, 0.72; ventral valve, 0.70; width, 0.75; greatest thickness, 0.64; height of area, 0.29; width of area and length of cardinal border, 0.33; width of deltidium in the middle, 0.08.

Missouri State collection from the Upper Coal Measures at Dallas. Maj. Hawn's collection from the Upper Coal Measures of K. T. It also passes up into the Permian Rocks.

RHYNCONELLA (*Camarophoria*) OSAGENSIS, *Swallow.*

Shell small, varying from orbicular to pentagonal, gibbous or depressed; *front* rounded or angular; *sides* converging regularly to the beak, where they meet at an angle varying from 85° to 111°; *dorsal valve* convex near the beak, somewhat depressed or concave in the center; the anterior part is marked with a deep sinus and from seven to twelve strong, angular, radiating plications; beak more or less pointed, larger than that of the opposite valve, slightly incurved, perforated with an oval foramen. *Ventral valve* shorter, always convex and marked with a ridge and plications corresponding to the

Pygidium semi-elliptical, elevated, width greater than length; surface very finely punctate, punctæ rather distant and arranged somewhat in quincunx; margin rather broad and smooth; *axal lobe* strongly arched transversely, gradually tapering, forming not quite four-fifths the total length; its width equal to about three-fourths the width of one lateral lobe; *rings* about eighteen, rounded on the dorsum and flattened at the extremities, transverse furrows narrow, distinctly impressed on the dorsum, becoming nearly obsolete before reaching the longitudinal furrows; *lateral lobes* rather strongly arched transversely; anterior margin angulated, apex of the angle elevated and situated nearest the axal lobe; segments eleven, rounded, curving slightly downwards, not furrowed; furrows between the segments rather deeply impressed, except the two posterior ones, which are quite shallow.

Dimensions.—Length of pygidium, .68; greatest width, .76; length of axal lobe, .56; greatest width of same, .23.

Geol. Pos. and Loc.—Collected by Prof. Swallow from the Middle Coal Measures at Lexington, Missouri.

Phillipsia major, *Shumard.*

Head and *thorax* unknown.

Pygidium large, elevated, approaching to semi-elliptical, a little wider than long; surface smooth, or very finely punctate; outline of lateral edges sinuate, margin broad, particularly towards the posterior extremity; *axal lobe* very much elevated, gently tapering, forming about five-sixths of the total length, not so wide as the lateral lobe, rather strongly arched longitudinally, sides with a broad, shallow groove running their whole length; rings 23, very strongly arched from side to side, angulated in the lateral depressions and their extremities directed obliquely backwards. The first six or seven from the front are very flat in a longitudinal direction, and are separated from each other by fine, scarcely impressed, transverse lines or furrows. Posterior to these, the furrows are distinctly impressed to the extremity of the lobe, while the rings gradually become rounded on the dorsum, but on the sides they still continue flattened. *Lateral lobes* moderately convex, obtusely angulated in front; segments twelve, rounded, slightly sinuate, simple; furrows rather strongly impressed, except the two last, which are nearly obsolete.

Dimensions.—Width of pygidium, $1\frac{20}{100}$ inch; length, $1\frac{10}{100}$; length of axal lobe, .93; width of same at anterior extremity, .30.

This is the largest known species of the genus. It was collected by Major Hawn in Clinton County, Missouri, and in the valley of Verdigris River, and twelve miles south of Lecompton on the Santa Fé road, Kansas Ter. It has only been found in the Upper Coal Measures.

PHILLIPSIA CLIFTONENSIS, *Shumard.*

Pygidium small, semi-elliptical, gibbous, width greater than the length; *axal lobe* elevated longitudinally, gently arched, dorsum slightly depressed, width at forward extremity about equal to one lateral lobe excluding the smooth margin, gradually tapering and terminating in a blunt point posteriorly; *rings*, from thirteen to fourteen, sub-granulose, separated by distinctly impressed furrows; lateral lobes angulated near the middle, flattened above and on the sides, well defined from the margin by a shallow but distinct furrow; *segments* seven, rounded, separated by distinct linear sulci; margin moderately wide and regularly convex.

Dimensions.—Length, .23; width, .25; height, .11; height of axal lobe, .04; length of same, .19.

Geol. Pos. and Loc.—This little species was obtained from the superior beds of the Upper Coal Measures, at Clifton Park, Kansas Ter.

Collected by Major Hawn.

CYTHERE (*Beyrichia*) AMERICANA, *Shumard.*

Valves ovate, sub-quadrate, smooth, height about half the length, somewhat gibbous; *dorsal edge* and extremities rounded, margined with a narrow border which is broadest at the larger end; *ventral margin* straight, occupying about two-thirds the length; *sides* marked inferiorly with three furrows, the middle one deeply impressed and extending obliquely from the ventral margin to the middle of the valve, the others rather shallow, and that near the smaller extremity curved.

Dimensions.—Length, .04; height, .02.

This beautiful little species was collected by Major Hawn from the Upper Coal Measures of the valley of Verdigris River, Kansas Ter. It is exceedingly abundant on thin slabs of limestone, associated with *Myalina recta.*

Description of NEW SPECIES *of* BRYOZOA *from* TEXAS *and* NEW MEXICO, *collected by Dr. George G. Shumard, Geologist of the U. S. Expedition for Boring Artesian Wells along the 32d Parallel, under the direction of Capt. John Pope, U. S. Corps Top. Eng.**

BY HIRAM A. PROUT, M.D.

FENESTELLA TRITUBERCULATA. (*Prout.*)

Corrallum funnel-shaped, or undulating fan-shaped, about three inches long, judging from the space exposed in the specimen.

Interstices or longitudinal rays large near base, more attenuated near the border, seldom bifurcated, bifurcations not acute in their angles; midrib or keel distinct, and raised above the terraced surface, which supports the cells on either side, marked by three tubercles to each fenestrule, inclusive of one upon the junction of each dissepiment with the longitudinal rays, and one near the centre of each fenestrule; these tubercles are rounded to a point, with the appearance of an obsolete cell pore at the top, and are much expanded longitudinally at the base; their number to each fenestrule is so constant that we have been induced to use this character in assigning to it a specific name.

Dissepiments short, large near base, longer and more delicate at the middle of the frond, about half a line apart, regular after leaving the base, sometimes opposite but most generally alternate, non-poriferous.

Fenestrules varied in form near base from the shortness and thickness of dissepiments, often ovate or oval, more regular in the widest portion of the expansion, being here more or less quadrangular or oval, about twice as long as broad; three in the space of two lines longitudinally, six in the space of two lines transversely.

Cell pores round, with a raised lip strongly indenting the border of the fenestrule, three to each fenestrule, or five counting the two, opposite the bounding dissepiments.

Reverse not seen, but a worn longitudinal rib shows the tubular-striate structure of the axis.

Comparisons.—This neat species resembles *F. patula* (*Mc*

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* The fossils of this paper were placed in my hands for description by Dr. B. F. SHUMARD, to whom Capt. POPE has entrusted the Palæontology of his important Expeditions.

POTERIOCRINUS RUGOSUS, *Shumard.*

The *calyx* of this beautiful Poteriocrinus is depressed, sub-hemispherical and its under surface broadly excavated. The *surface* is generally thickly studded with short rugæ, strong and irregularly disposed, but sometimes with granulæ.

The *base* is rather small, pentagonal, concave, and profoundly excavated in the middle. The pieces are rhombic, recurved, and their lateral edges much the longest. The *columnar facet* is circular, occupies about one-half the diameter of the base, and is situated at the bottom of a deep excavation. The central perforation is small and pentalobate. In the interior of the calyx the base forms a strong mammillary swelling.

The *sub-radial pieces* are rather thick, longitudinally recurved, and slightly wider than long. Four of them are pentagonal, with basal and infero-lateral edges about equal, and superior edges very slightly arched. The fifth piece is hexagonal and its superior edge very short.

The *1st radial pieces* are very thick, transverse; inferior edges very slightly concave, and more than double the length of the lateral edges. The superior edge is nearly straight, bevelled outwards, the articular facet well developed, and marked similar to that of the preceding species, though it is much narrower.

2d Radial pieces.—There is in the Missouri collection a single 2d radial piece from Putnam County, which apparently appertains to this species. It is short, very thick, pentagonal and an axillary piece. The articular facets are broad, strongly marked, and their edges strongly crenulated.

Anal pieces.—The principal anal piece only remains attached to the calyx. It is very small, elongate-pentagonal, and wedged in between the lateral edges of two of the 1st radials, projecting above the plane of their superior edges.

Dimensions.—Height of calyx, .32; diameter, .92; diameter of base, .25; height of sub-radials, .19; height of 1st radials, .28.

Geol. Pos. and Loc.—This elegant Poteriocrinus was found by Prof. Swallow in the Coal Measures of the bluffs of the Missouri River, and in the same geological position in Putnam County near Black-Bird Creek. It appertains to the same group of the genus *Poteriocrinus* as the preceding species.

ARCHÆOCIDARIS ACULEATUS, *Shumard.*

Of this handsome species of Archæocidaris, we have, merely, specimens of the interambulacral plates and some of the primary spines.

The *interambulacral plates* are thin, irregularly hexagonal,

besides, the latter has fenestrules nearly double as wide as the interstices, being at the same time strongly corticated, at least on the reverse.

It resembles the *F. antiqua* (*Gold sp. McCoy*), but differs by the thickness of its interstices, as well as by the greater length and fewer number of fenestrules in a given space.

Locality.—Permian White Limestone, Guadalupe Mountain, New Mexico.

FENESTELLA CORTICATA. (*Prout.*)

Corrallum wide, long fan-shaped; bifurcations few, caused by the mere insertion of a middle line of fenestrules; length unknown—that of the specimen at least two inches.

Longitudinal rays or interstices large, only about one-third less than the fenestrules, tubular-striate where worn, the striæ expanding as they ascend between each oscule, from one dissepiment to another, about seven to two lines.

Dissepiments short, stout, expanding at junction with rays, seeming to surround them, non-poriferous; seven in the space of two lines.

Fenestrules nearly as wide as long where worn down, presenting hollow squares with thin sharp edges; where well preserved with the cortex investing them, they are nearly oval; about six transversely, or longitudinally.

Cell pores indistinct, but sufficiently marked to show three large cells to each fenestrule, or five counting the two which belong to the dissepiments above and below.

Reverse distinctly corticated, the surface showing an irregular line of tubercles upon each ray, with scattered pores.

This description is drawn from a specimen which is much weathered, but by careful observation we trust we have been able to define its relations:—It bears an analogy to the *F. patula* (*McCoy*), and the *F. antiqua* (*Gold. sp. ib.*), but differs in the same relations as the *F. Popeana.* It may, indeed, be only a variety of the latter; but, from its fan-shaped expansion, the greater length of its bifurcations, the smaller size of its fenestrules, and the wider separation of its pores transversely on the two sides of the longitudinal rays, we are inclined to believe that better preserved specimens will enable us to establish a specific difference. The *F. corticata* and *F. Popeana* both resemble the *Retepora* (*F.*) *tenuifilia* and *R.* (*F.*) *flabellata*, *Phillips*, but his descriptions are so meagre that it would be difficult to determine fully their analogies or differences. Both of the latter seem to be keeled, and their dissepiments are represented, both in the text and plates, as being thinner than in our two species.

Locality.—Collected by Dr. Geo. G. Shumard from the Carboniferous Limestone of the Organ Mountains.

with nearly equi-distant, short, flattened, thorn-like processes, which rise from a broad base and are directed obliquely upward. These thorns, of which from twelve to fourteen may be counted on either side of the spine, do not rise from the same horizontal line, but the bases of those of one side are higher than those of the other. The expanded part of the base of the spines is marked with coarser and more distinct striæ than the rest of the surface, and the outer edges are strongly and elegantly striated.

Dimensions.—Width of interambulacral plate, .24; height, .18; length of primary spines, about 2½ inches; diameter, including thorns, .10

Geol. Pos. and Loc.—This beautiful species was collected by Prof. Swallow in the Middle Coal Measures, at Lexington, Missouri, in thin layers of limestone parting beds of shale. It is associated with *Fusulina cylindrica*, *Chonetes Smithii*, and *Orthisina Missouriensis*.

ARCHÆOCIDARIS MEGASTYLUS, *Shumard*.

The interambulacral plates of this species in the collection are large, hexagonal, wider than long, and rather thick. The areolar surface is very broad, nearly circular, slightly concave at its exterior portion and rising gently to the base of the central boss. It is encircled by a single series of small, secondary tubercles. The boss is broad, smooth, and the central tubercle deeply perforated.

The primary spines are long, robust, cylindrico-fusiform, and the transverse section circular. The surface is very finely striated longitudinally, and studded with rather distant granules, or minute, short spines, arranged spirally or promiscuously. The ring at the base is oblique to the axis, its border neatly crenulated, and the diameter less than the greatest diameter of the spine. The socket is deep, rather wide, and its margin smooth. The neck is marked with a slightly raised ring, which is finely striated longitudinally.

Dimensions.—Width of interambulacral plate, .78; height, .64; length of primary spines, about 3 inches; greatest diameter of same, .34.

The interambulacral plates of this species are very analagous to those of the *A. aculeatus*, but their size is nearly double. The spines are very peculiar and can scarcely be mistaken for those of any of its congeners.

Geol. Pos. and Loc.—Upper Coal Measures, Kansas Ter.

Collected by Major Hawn near the head-waters of Verdigris River and in the valley of Cotton-wood Creek.

PHILLIPSIA MISSOURIENSIS, *Shumard*.

Head and *thorax* unknown.

Fenestrules long, irregular in form, generally quadrangular, seven or eight times as long as the width of the interstices, deeply indented or knotted on the sides by large and projecting cells; two and one-half in the space of two lines vertically, about four in two lines transversely.

Cells large and prominent, distant, placed in somewhat varied series on the two sides of the longitudinal ribs, alternate, six or eight to each fenestrule.

This species resembles no other which I have seen described; it has been described from a fragment well preserved on the surface of a black limestone, with other more imperfect branches embedded in the matrix; the stems are sometimes slender, and become irregularly thickened near the bifurcations, where they have the indistinct appearance of another line of pores, between the prominent pores on the sides. In some large stems, which could not be decided as certainly belonging to this species, there were indistinct appearances of three lines of cells.

FENESTELLA SHUMARDII. (*Prout.*)

Corrallum formed of delicate branches apparently without dissepiments, most probably fan-shaped or dendritic.

Interstices bent, somewhat contorted in places, very slender, frequently bifurcated at the distance of one to one and a half lines apart; keel delicate, a fine line frequently interrupted by the infringement of the cells.

Dissepiments still more slender than the interstices, placed at nearly regular intervals, bowed towards the border, not seen with the naked eye, or a very low power of the magnifying glass, much depressed, swelling at their junctions with the dissepiments.

Fenestrules quadrangular or oval, eight in the space of two lines transversely, about eight to nine in the same space vertically, indented by the large pores.

Cell pores comparatively large, placed near reverse or low in the fenestrules, about two to each fenestrule, one to each dissepiment, sometimes two where the dissepiment is expanded, lip thin but cells more or less projecting.

This small and beautiful species we have dedicated to Dr. George G. Shumard, Geologist to the United States Expedition under Capt. John Pope, whose ardent labors and scientific zeal have contributed so effectually to unfold the Geology of a large portion of the hitherto unexplored regions of Texas and New Mexico.

Locality.—In dark gray subcrystalline limestone of the Carboniferous Period, from the Organ Mountains, New Mexico.

compton on the Santa Fé road, Kansas Ter. It has only been found in the Upper Coal Measures.

PHILLIPSIA CLIFTONENSIS, *Shumard.*

Pygidium small, semi-elliptical, gibbous, width greater than the length; *axal lobe* elevated longitudinally, gently arched, dorsum slightly depressed, width at forward extremity about equal to one lateral lobe excluding the smooth margin, gradually tapering and terminating in a blunt point posteriorly; *rings*, from thirteen to fourteen, sub-granulose, separated by distinctly impressed furrows; lateral lobes angulated near the middle, flattened above and on the sides, well defined from the margin by a shallow but distinct furrow; *segments* seven, rounded, separated by distinct linear sulci; margin moderately wide and regularly convex.

Dimensions.—Length, .23; width, .25; height, .11; height of axal lobe, .04; length of same, .19.

Geol. Pos. and Loc.—This little species was obtained from the superior beds of the Upper Coal Measures, at Clifton Park, Kansas Ter.

Collected by Major Hawn.

CYTHERE (*Beyrichia*) AMERICANA, *Shumard.*

Valves ovate, sub-quadrate, smooth, height about half the length, somewhat gibbous; *dorsal edge* and extremities rounded, margined with a narrow border which is broadest at the larger end; *ventral margin* straight, occupying about two-thirds the length; *sides* marked inferiorly with three furrows, the middle one deeply impressed and extending obliquely from the ventral margin to the middle of the valve, the others rather shallow, and that near the smaller extremity curved.

Dimensions.—Length, .04; height, .02.

This beautiful little species was collected by Major Hawn from the Upper Coal Measures of the valley of Verdigris River, Kansas Ter. It is exceedingly abundant on thin slabs of limestone, associated with *Myalina recta.*

Comparison.—It will be seen from the description that this species resembles the *Fenestella retiformis* (*Mc Coy*)—*Keratophytes retiformis* (Schlotheim),—but differs in the size of its interstices, in the large tubercles on the midrib, and the irregular disposition or the cell pores, and the absence of indentatation by those of the fenestrules.

Note.—There seems to be some discrepancy in McCoy's description of *F. retiformis;* it may, however, prove to be a typographical error. We are told that the interstices are thin, the fenestrules about two thirds the width of the interstices, and nearly twice as long as broad, while the dissepiments are strong; yet the space of two lines, longitudinally or transversely, give the same number of fenestrules, or five to six. Now this is an impossibility in a mathematical point of view, so that some error must have crept into his description.

Collected by Dr. Geo. G. Shumard, from the Carboniferous Limestone of the Organ Mountains, New Mexico.

ESCHARA(?) CONCENTRICA. (*Prout.*)

Corrallum broad, branched, swelled at base and bifurcation, compressed or flattened; outer edge thin, smooth; longitudinal ridges separating cells minutely striate, striæ surrounding the prominent lip of the cell in concentric lines; if any accessory cells, one placed at the base of the aperture, irregularly punctate from weathering; cells slightly ventricose, oval, with the appearance of a raised round lip, arranged in alternating lines between the ridges, or in transversely oblique lines; central axis distinct, a thin plate slightly waved and membraniform; cells about fifteen transversely across the widest part of the bifurcation, which is about four lines wide, eight in the narrowest part, which is about two and half lines wide, about ten at the base, which is three lines wide; cellules fibrous on both sides.

We have placed this species provisionally among the *Eschara;* it is different from the *E. scalpellum* (Lonsdale), and resembles in the disposition of its surface the *E. quinqueporata* of Hagenow.

Locality.—Organ Mountains, New Mexico.

Collected by Dr. Geo. G. Shumard.

ESCHARA(?) TUBERCULATA. (*Prout.*)

Corrallum somewhat flattened, border round, wider than long, ridges minutely granular and tubercled between the cells.

Cells not ventricose, alternate in the furrows, or in transverse oblique lines; no apparent lip, but the appearance of indistinct accessory pores in a circle around the cells; about one line and three-fourths wide, with nine lines of cell openings, about six in the same space longitudinally.

Dimensions.—Angle of divergence of sides, 46°; length, 0.42 of an inch; width at summit, 0.27; length of base, 0.14; width of same, 0.14.

Our species differs from *C. acutus* (McCoy), by its more slender form, narrow base, convexity of the summit, and other important characters.

Occurs in the Devonian strata of the Falls of the Ohio, and on Bear-Grass Creek, near Louisville, Kentucky; also in the vicinity of Columbus, Ohio. Beautiful examples of this species are to be found in the cabinet of my friend, Dr. L. P. Yandell, at Louisville, Ky.

Codaster Americanus, *N. sp.*

The *body* of this little species presents the form of an inverted pyramid, with a convex pentagonal base, and its apex very slightly truncated. The surfaces of the basal and radial pieces are covered with exceedingly delicate striæ, whose direction are nearly parallel with the borders.

The *base* is subconic, obscurely triangular, wider than long, and occupies about two-fifths the entire length. Its superior edges are but slightly excavated, and the under surface bears a very small columnar facet, which appears to be circular.

The *radial pieces* are longer than wide, most prominent in the middle, flattened on the sides, and their lateral edges subparallel or slightly divergent in an upward direction. The pseudo-ambulacral spaces are very short, moderately excavated, and their edges diverge very rapidly. The limbs are also quite short and bent slightly inwards.

The pseudo-ambulacral fields are narrow, linear, and separated from each other by broad, triangular spaces, marked similar to those of the preceding species. The specimen is imperfect at the summit, so that the form and number of the pore pieces can not be determined.

This species is very similar to *Codaster pyramidatus*, of which it may be merely a strongly marked variety. The principal differences are the much greater fineness of the striæ of the surface, the entire absence of the broad depressed band at the lateral sutures, and its shorter radial pieces.

Dimensions.—Length, 0.29; width at summit, 0.20; length of base, 0.10; width of same, 0.12; length of radial pieces, 0.15.

Found in the Devonian strata at the Falls of the Ohio.

Pentremites (Codaster?) Kentuckyensis, *N. sp.*

(Pl. IX., fig. 5.)

We possess merely fragments of this species, consisting of one basal and two of the radial pieces, but they are so differ-

besides, the latter has fenestrules nearly double as wide as the interstices, being at the same time strongly corticated, at least on the reverse.

It resembles the *F. antiqua* (*Gold sp. McCoy*), but differs by the thickness of its interstices, as well as by the greater length and fewer number of fenestrules in a given space.

Locality.—Permian White Limestone, Guadalupe Mountain, New Mexico.

FENESTELLA CORTICATA. (*Prout.*)

Corrallum wide, long fan-shaped; bifurcations few, caused by the mere insertion of a middle line of fenestrules; length unknown—that of the specimen at least two inches.

Longitudinal rays or interstices large, only about one-third less than the fenestrules, tubular-striate where worn, the striæ expanding as they ascend between each oscule, from one dissepiment to another, about seven to two lines.

Dissepiments short, stout, expanding at junction with rays, seeming to surround them, non-poriferous; seven in the space of two lines.

Fenestrules nearly as wide as long where worn down, presenting hollow squares with thin sharp edges; where well preserved with the cortex investing them, they are nearly oval; sbout six transversely, or longitudinally.

Cell pores indistinct, but sufficiently marked to show three large cells to each fenestrule, or five counting the two which belong to the dissepiments above and below.

Reverse distinctly corticated, the surface showing an irregular line of tubercles upon each ray, with scattered pores.

This description is drawn from a specimen which is much weathered, but by careful observation we trust we have been able to define its relations:—It bears an analogy to the *F. patula* (*McCoy*), and the *F. antiqua* (*Gold. sp. ib.*), but differs in the same relations as the *F. Popeana.* It may, indeed, be only a variety of the latter; but, from its fan-shaped expansion, the greater length of its bifurcations, the smaller size of its fenestrules, and the wider separation of its pores transversely on the two sides of the longitudinal rays, we are inclined to believe that better preserved specimens will enable us to establish a specific difference. The *F. corticata* and *F. Popeana* both resemble the *Retepora* (*F.*) *tenuifilia* and *R.* (*F.*) *flabellata, Phillips*, but his descriptions are so meagre that it would be difficult to determine fully their analogies or differences. Both of the latter seem to be keeled, and their dissepiments are represented, both in the text and plates, as being thinner than in our two species.

Locality.—Collected by Dr. Geo. G. Shumard from the Carboniferous Limestone of the Organ Mountains.

Fenestella intermedia. (*Prout.*)

Corrallum most probably fan-shaped; size not known, as we have only a fragment near the outer border.

Interstices or longitudinal rays slender, round, or compressed at the sides, so as to render them subangular on the obverse, more or less flexuous, irregularly dichotomising; three branches from one stem dichotomise first at two, then at one, two, and even three lines apart. *Keel* nearly obsolete; seems to have been somewhat tubercled.

Dissepiments about one-third as large as the interstices, round, expanded as they terminate on the longitudinal rays, depressed below the general surface, sometimes opposite but most frequently alternate, about one line apart.

Fenestrules irregular in form, but generally long rectangular rounded at the angles, from one to four times as wide as the interstices, lanceolate at the bifurcations, about two in two lines longitudinally, about five or six transversely.

Cells from five to seven, most frequently six, on each side of the fenestrules; small, oval; longitudinal lips thin; the two lower cells, with a supernumerary, are placed in a triangular expansion at the bifurcations; periphery of the fenestrules not indented, the cells seeming to lie rather under the longitudinal rays.

Comparisons.—This graceful species bears a close analogy to *F. Milleri* (*Lonsdale, as more fully described by McCoy*), but differs in the length of its fenestrules, the want of alternation and anastamosis among the cells, and in the number of the cell pores to each fenestrule.

It resembles the *F. subantiqua* (*D'Orbigny*), *F. antiqua* (Lonsdale), but differs by its slender dissepiments, their greater distance apart, and the greater length of its fenestrules.

This species being analagous in its general form and other characters to *F. Milleri* and *F. subantiqua*, I have assigned to it the name of *intermedia.*

Locality.—Collected by Dr. George G. Shumard from the Carboniferous Limestone of the Organ Mountains.

Fenestella variabilis. (*Prout.*)

Corrallum large, branched, bifurcating irregularly, most probably fan-shaped.

Interstices stout, slender near border, minutely subangular, striated irregularly, thickened near bifurcations.

Dissepiments slender, expanded at junction with longitudinal rays, striated, or marked with indistinct cells, at variable distances apart, about one line and a quarter in the best preserved portion of the specimen.

Fenestrules long, irregular in form, generally quadrangular, seven or eight times as long as the width of the interstices, deeply indented or knotted on the sides by large and projecting cells; two and one-half in the space of two lines vertically, about four in two lines transversely.

Cells large and prominent, distant, placed in somewhat varied series on the two sides of the longitudinal ribs, alternate, six or eight to each fenestrule.

This species resembles no other which I have seen described; it has been described from a fragment well preserved on the surface of a black limestone, with other more imperfect branches embedded in the matrix; the stems are sometimes slender, and become irregularly thickened near the bifurcations, where they have the indistinct appearance of another line of pores, between the prominent pores on the sides. In some large stems, which could not be decided as certainly belonging to this species, there were indistinct appearances of three lines of cells.

FENESTELLA SHUMARDII. (*Prout.*)

Corrallum formed of delicate branches apparently without dissepiments, most probably fan-shaped or dendritic.

Interstices bent, somewhat contorted in places, very slender, frequently bifurcated at the distance of one to one and a half lines apart; keel delicate, a fine line frequently interrupted by the infringement of the cells.

Dissepiments still more slender than the interstices, placed at nearly regular intervals, bowed towards the border, not seen with the naked eye, or a very low power of the magnifying glass, much depressed, swelling at their junctions with the dissepiments.

Fenestrules quadrangular or oval, eight in the space of two lines transversely, about eight to nine in the same space vertically, indented by the large pores.

Cell pores comparatively large, placed near reverse or low in the fenestrules, about two to each fenestrule, one to each dissepiment, sometimes two where the dissepiment is expanded, lip thin but cells more or less projecting.

This small and beautiful species we have dedicated to Dr. George G. Shumard, Geologist to the United States Expedition under Capt. John Pope, whose ardent labors and scientific zeal have contributed so effectually to unfold the Geology of a large portion of the hitherto unexplored regions of Texas and New Mexico.

Locality.—In dark gray subcrystalline limestone of the Carboniferous Period, from the Organ Mountains, New Mexico.

FENESTELLA NORWOODIANA. (*Prout.*)

Corrallum most probably cyathiform, small and delicate, reverse only exposed.

Longitudinal rays large, nearly twice the size of the fenestrules, minutely granular, seldom branched, division trifid at one point.

Dissepiments short, round, not depressed.

Fenestrules generally sharp, quadrangular, seldom oval, slightly longer than broad, sixteen or seventeen in the space of three lines longitudinally, eighteen to nineteen in the same space transversely.

Obverse or *inner face* seen by removing a portion.

Interstices characterized by a minute, sharp-edged and occasionally tubercled keel, separating two alternate rows of large vesicular cells, with small pore openings one to each dissepiment, and one to each fenestrule where regular; sometimes two to a fenestrule, but this is an exception to the type.

Comparison.—This minute and beautiful species resembles the *F. cribrosa* (*Hall*), from which it is distinguished by the greater number of fenestrules in a given space. Further comparison can not be instituted, as Hall did not see the obverse in his specimen.

Locality.—Carboniferous Limestone of Organ Mountains, New Mexico. Collected by Dr. Geo. G. Shumard.

It is with much pleasure that we dedicate this handsome species to our friend Dr. J. G. Norwood, whose labors have contributed so largely to our knowledge of Western Geology and Palæontology.

FENESTELLA SUBRETIFORMIS. (*Prout.*)

Corrallum fan or cup-shaped, waved transversely, probably two or three inches long, reverse only exposed.

Interstices stout, minutely granular or cellular striate, the striæ seeming to flow upon the interstices so as to surround the fenestrules with flexuous concentric lines, bifurcations not frequent, situated two and a half to three and a half lines apart.

Dissepiments nearly as large as interstices, granular, or striate when much worn.

Fenestrules oval, generally opposite, or at least opposite in waved transverse lines, irregular in size, five or six in the space of two lines, measured transversely or longitudinally.

Obverse, or *medallion face*, interstices marked by a middle line of large, irregularly sized tubercles, with larger and smaller cells irregularly placed around them; we thought we could perceive traces of a row of larger cells on the two sides of the fenestrule, about two to each space, but these when seen were most frequently opposite to the large tubercles.

Comparison.—It will be seen from the description that this species resembles the *Fenestella retiformis* (*Mc Coy*)—*Keratophytes retiformis* (Schlotheim),—but differs in the size of its interstices, in the large tubercles on the midrib, and the irregular disposition of the cell pores, and the absence of indentatation by those of the fenestrules.

Note.—There seems to be some discrepancy in McCoy's description of *F. retiformis*; it may, however, prove to be a typographical error. We are told that the interstices are thin, the fenestrules about two thirds the width of the interstices, and nearly twice as long as broad, while the dissepiments are strong; yet the space of two lines, longitudinally or transversely, give the same number of fenestrules, or five or six. Now this is an impossibility in a mathematical point of view, so that some error must have crept into his description.

Collected by Dr. Geo. G. Shumard, from the Carboniferous Limestone of the Organ Mountains, New Mexico.

ESCHARA(?) CONCENTRICA. (*Prout.*)

Corrallum broad, branched, swelled at base and bifurcation, compressed or flattened; outer edge thin, smooth; longitudinal ridges separating cells minutely striate, striæ surrounding the prominent lip of the cell in concentric lines; if any accessory cells, one placed at the base of the aperture, irregularly punctate from weathering; cells slightly ventricose, oval, with the appearance of a raised round lip, arranged in alternating lines between the ridges, or in transversely oblique lines; central axis distinct, a thin plate slightly waved and membraniform; cells about fifteen transversely across the widest part of the bifurcation, which is about four lines wide, eight in the narrowest part, which is about two and half lines wide, about ten at the base, which is three lines wide; cellules fibrous on both sides.

We have placed this species provisionally among the *Eschara*; it is different from the *E. scalpellum* (Lonsdale), and resembles in the disposition of its surface the *E. quinquepunctata* of Hagenow.

Locality. - Organ Mountains, New Mexico.

Collected by Dr. Geo. G. Shumard.

ESCHARA(?) TUBERCULATA. (*Prout.*)

Corrallum somewhat flattened, border round, wider than long, ridges minutely granular and tuberoled between the cells.

Cells not ventricose, alternate in the furrows, or in transverse oblique lines; no apparent lip, but the appearance of indistinct accessory pores in a circle around the cells; about one line and three-fourths wide, with nine lines of cell openings, about six in the same space longitudinally.

We have placed this species, also, among *Eschara* provisionally. Notwithstanding the able effort of D'Orbigny to bring about harmony and regularity in the chaos which prevailed in the classification of the *Bryozoa*, we are inclined to believe that some confusion still remains in regard to the true generic characters of *Eschara*, *Sulcapora*, *Ptilodictya*, and *Sulcocava*. Whether these have been separated upon inadequate structural differences, we are not prepared to determine.

Locality—Organ Mountains, New Mexico.

Collected by Dr. Geo. G. Shumard.

First of a Series of Descriptions of Carboniferous Bryozoa.

BY H. A. PROUT, M.D.

FENESTRALIA, *new subgenus.* (*Prout.*)

Fenestralia St. Ludovici. (*Prout.*)

Corrallum flabelliform, bifurcating frequently, and rapidly expanding into a broad frond, folded upon itself longitudinally near the top.

Longitudinal rays or *interstices* large, round near base, more angular towards the middle of the frond; midrib indistinct near the base, very prominent and well marked where slightly weathered.

Dissepiments short, strong, and enlarged at the junction with the longitudinal rays.

Fenestrules long oval or elliptical, rarely quadrangular, two to two and a half in two lines measured longitudinally, four in two lines transversely.

Cells in two rows on either side of the midrib, most generally opposite in the two rows, and opposite on the two sides of the midrib, five to each fenestrule, or twenty inclusive of the two rows on each side.

Reverse, fenestrules quadrangular from the want of expansion in the junction of the dissepiments, rays and dissepiments rounded, minutely tubular-striate.

This *Fenestella* is characterized by a double row of pores on each side of the midrib, without a divisional keel between the two series of pores upon the sides. No generic description of *Fenestella* would include this species except the very general original description of Lonsdale. As limited by D'Orbigny or King, it would be a wrong collocation to place it among *Fenestella* proper. The existence of two rows of pores on each side without a separating keel entitles it to be ranked as a subgenus of *Fenestella*, as much as two approximating lines of cells without a keel would give authority to M. D'Orbigny to separate *Reteporina*, or minute lines of pores on the midrib would authorize him to establish the genus of *Fenestrellina*. The same remarks may be applied to the *Keratophytes of Schlotheim*, the *Polypora of McCoy*, and the *Synocladia of King*. If the *Keratophytes* is to be separated because it has more than two serial lines of pores without median ribs, we see no good and sufficient reason why our subgenus may not be established on the characters which we have indicated above. It is certainly a departure from the original type of *Fenestella* as limited by D'Orbigny, as well as a departure from the broader limit given by King, in the absence of median ridges between the double series of pores.

We have another specimen from Warsaw, Illinois, which seems to be larger and somewhat differently bifurcated; in this the cells are large and tuberculated in the two lines, prominently indenting the sides of the fenestrule, but the number of pores to the fenestrules could not be determined because of the depression of the dissepiments; it seems to be a larger and better preserved species of this subgenus.

Locality.—Upper layers of St. Louis Limestone, St. Louis.

FENESTELLA PLUMOSA. (*Prout.*)

Corrallum forming a broad, waved, funnel-shaped frond, about three inches wide, one and three-quarters high; bifurcations frequent, at from one to two or more lines apart.

Interstices or *longitudinal rays* not slender, beautifully striate on reverse; keel moderately large, round, slightly waved, dilating into three or more low tubercles to each fenestrule, waved linear where not worn. These tubercles are less than their diameter apart, sometimes opposite, and sometimes alternating with the cell pores.

Interstices thick, round, short, swelling at their junction with the longitudinal rays so as to give a long oval or suboval form to the fenestrules.

Fenestrules in regular lines between the bifurcating and anastomosing longitudinal rays, generally six in the space of two lines longitudinally, about ten in the same space transversely, being nearly twice as long as broad.

Cell pores large, indenting the margin of the fenestrule, three to each fenestrule on each side.

Reverse beautifully striate where not too much worn; where much weathered so as to be cut down to the base of the cells, these are seen to be large, apparently angular, alternately in juxtaposition without any intervening pores, or mesial solid division. There is a distinct pedicle to the frond, the weathered appearance of other rootlets, and also a process shooting down from the longitudinal rays, at the distance of about three lines, the office of which seems to have been to give greater firmness to the position of the funnel-shaped corrallum. There is near the base, also, the appearance of a thick, yellowish, stony crust, which is irregularly porous, and which seems to be a part of the incrustation which covered this polypidom in its recent state.

Comparison.—This species resembles very closely the *F. retiformis* of *Schlotheim*, but differs in the greater thickness of the interstices and dissepiments, and the want of constancy and prominence in the tubercles. It may be observed here, that any *Fenestella* with sessile cells, or cells implanted in the midrib, are liable to appear in the weathered condition more or less tuberculous. At one point in the specimen before us where there seems to be no weathering, the keel is linear, and waved by the interruption of these tuberculous expansions. The imperfect development of the tubercles, and the size of the interstices and dissepiments, are sufficient, we believe, to separate it from the *F. retiformis*. *Locality.*—Warsaw, Illinois.

L. 4x5 T.
| 20—25 | 2 lines.

POLYPORA VARSOVIENSIS. (*Prout.*)

Corrallum fan-shaped, or from the concavity near the base most probably funnel-shaped, only a fragment of a larger specimen, about one inch long and three-fourths of an inch wide, the balance of the expansion having been worn away.

Interstices broad, round near base, more flattened above, having three irregular lines of pores near the pedicle, four or five in the more expanded portion of the frond; the interstices and fenestrules disappear at one point, and there is a broad expansion for the space of three rays and about ten or twelve dissepiments, studded with numerous cell pores, above which the longitudinal rays and fenestrules appear again, and proceed regularly toward the border of the frond.

Dissepiments short, broad, depressed, striated, non-poriferous, and much enlarged at the junction with the longitudinal rays.

Fenestrules oval, forming regularly dichotomizing lines, where not interrupted by the expansion referred to above; about five in the space of two lines transversely, four to five longitudinally, or twenty to twenty-five in the space of two lines square.

Cell pores not in regular lines, large, round, with sharp lips rising obliquely upward from the face of the corrallum, with interstices moderately wide, and sometimes minutely porous; axis, where seen, minutely tubular-striate.

A question of some interest arises in regard to the expansion referred to above: was this the result of a wound in the frond, or did it proceed from excessive formative action in the longitudinal rays, by which their growth was too much developed to give rise to oscules? We are inclined to believe that it must have resulted from a wound, or injury of the frond, as the cells seem to have been directed from the two bounding longitudinal rays to heal the breach of continuity; it is well known that the frond of our modern *Gorgonias* when injured are repaired in a similar manner.

Comparisons.—Does not resemble the *Gorgonia* (*Polypora*) *fastuosa*, *G. Goldfussiana* or *G. retiformis* of *DeKoninck;* there is a slight resemblance between it and the *retiformis* in the shape of the fenestrules, but the arrangement of the cells is different in the two species. It bears no resemblance to *Retepora* (*Polypora*) *laxa* or *Retepora* (*Poly.*) *flustriformis* (*Phillips*). The *Polypora incepta* of *Hall* is a carinated species, and approaches more nearly to *Synocladia.* We have as yet seen no description of the *P. intertexta* (*Portlock*), the *P. flexuosa* (*D'Orbigny*), the *P. bifurcata*, *P. orbieribrati* (*Keyserling*), nor any of the species of *Mc Coy;* but as nearly all these have their nomenclature founded on certain specific characters, we believe we are fully warranted in giving to our species a new name. *Locality*—Warsaw, Illinois.

Table of Genera and Species of the Family Blastoidea, etc. (*Continued.*)

Genera and Species.	Synonyms and References.	Silurian Syst.: Lower Helderberg.	Devonian: Upper Helderb'g.	Devonian: Chemung Group.	Carboniferous: Encrinital Limestone.	Carboniferous: Archimedes Limestone.	Principal Localities.
Pentremites, *Say*. (*Continued.*)							
P. laterniformis	Ow. & Shum., 1850, Jour. Acad. Nat. Sci. Philad., Vol. 2, p. 66, pl. 7, fig. 15. *P. obliquatus*, Rœm., 1852, Monog. Blast., p. 47, T. 3, fig. 11 *a*, *b*.					*	Greenville, and Spergen Hill, Indiana; Ste. Genevieve and St. Louis Counties, Missouri.
P. sulcatus	Rœmer, 1852, *Pentatrematites sulcatus*, Monog. Blastoid., p. 34, T. 3, fig. 10 *a—c*.					*	Chester, Long Prairie, Ill.; Sparta, Crab Orchard, Tenn.; Mt. Sano, Alab.; Perry Co., Missouri.
P. (*new sp.*)	....	*					Birmingham, Missouri.
P. Koninckana	Hall, 1856, Ext. Tr. Albany Inst., Vol. 4.					*	Spergen Hill, & Bloomington, Ind.; Alton, Ills.
P. conoideus	Hall, Tr. Albany Inst., Vol. 4.					*	Spergen Hill, and Bloomington, Indiana; St. Louis Co., Mo.
P. granulatus	Rœmer, 1852, Mon. Blast., p. 43, T. 3, fig. 13. *Granatocrinus cidariformis*, Troost, 1849, List of Crinoids Tenn., Pro. Am. Ass. Camb. Meet., p. 62.				*		White's Creek Springs, Tennessee; Allen County, Kentucky; near Tuscumbia, Alabama.
P. Norwoodii	Ow. & Shum., 1850, Jour. Acad. Nat. Sci. Philad., N. Ser., Vol. 2, p. 64, pl. 7, fig. 13 *a—c*.				*		Oquawka, and Quincy, Illinois; Burlington, and Augusta, Iowa; Hannibal, and Clarke Co., Mo.

P. MELO	Ow. & Shum., 1850, J. Ac. N. Sci. Phil., N. Ser., Vol. 2, p. 65, pl. 7, fig. 14 *a—c*.				*		Burlington, Augusta, Io.; Louisiana, Hannibal, Mo.; Monmouth, Ill.
P. (*new sp.*)	......				*		Callaway Co., Mo.
P. SAYI	Shum., 1855, 2d Rep. Geol. Surv. Missouri, pt. 2, p. 185, pl. B, fig. 1 *a—d*.				*		Boone, Marion, Jefferson, St. Louis and Ste. Genevieve Cos., Mo.
P. RŒMERI	Shum., 1855, 2d Rep. Geol. Survey Missouri, pt. 2, p. 186, pl. B, fig. 2 *a—d*.			*			Providence and Boone Counties, Missouri.
P. CURTUS	Shum., 1855, Geol. Surv. Mo., pt. 2, 2d Rep., p. 186, pl. B, fig. 3 *a—b*.					*	Fenton, St. Louis County, Missouri.
P. VERNEUILII	*Olivanites Verneuilii*, Troost, 1849, List of Crin. Tenn. (Pro. Amer. Assoc. Camb. Meet.) p. 62. *Pentrem. Verneuilii* (Beadle), D'Orb. Pro. Pal., Vol. 1, p. 102.—*Elæacrinus Verneuilii*, Rœm., 1852, Monog. Blast., pt. 59, T. 5, fig. 1 *a—d*.		*				Falls of Ohio, and Charleston Landing, Indiana; Columbus, Ohio; near the mouth of Pine Creek, Iowa.
P. DECUSSATUS	Shum. (Described in this paper.)				*		"Button-Mould Knob," Kentucky.
P. REINWARDTII	Troost, Trans. Geol. Soc. Penn., Vol. 1, p. 224, pl. X. *Pentratrematites Reinwardtii*, Rœmer, 1852, Monog. Blast., p. 52, pl. 3, fig. 13 *a—c*.	*					Decatur County, Tennessee; Bear Grass Creek, near Louisville, Kentucky.
P. GROSVENORI	Shum, 1857, Trans. Acad. Sci. St. Louis.					*	Spergen Hill, Floyd Co., Indiana.
P. LINEATUS	Shum. (Described in this paper.)				*		Monmouth, Illinois.
P. STELLIFORMIS	Ow. & Shum., 1850, Jour. Acad. Nat. Sci. Philad., New Ser., Vol. 2, p. 67, pl. 7, fig. 16 *a—b*.				*		Burlington, Iowa; Hannibal, Missouri; Monmouth, Illinois.
CODASTER, *McCoy*.							
C. PYRAMIDATUS	Shum. (Described in this paper.)		*		*		Falls of Ohio, Columbus.
C. KENTUCKYENSIS	Shum. (Described in this paper.)						Button-Mould Knob, Kentucky.
C. AMERICANUS	Shum. (Described in this paper.)		*				Falls of Ohio.
ELEUTHEROCRINUS, *Shum. & Yan.*							
E. CASSEDAYI	Shum. & Yan., 1856, Proceed. Acad. Nat. Sci. Phil., Vol, 8, p. 74, pl. 2, fig. 1—5.		*				Bear-Grass Creek, near Louisville, Kentucky.

ent from those of any known species that we feel justified in characterizing them.

The basal piece which remains preserved in our specimen is thin, pentagonal, wider than long, convex, and with slightly diverging sides. Its upper edge is concave and longer than the lateral edges; below is the segment of a small, somewhat prominent ring, from which radiate three broad, obtuse, rounded ridges, two of them terminating at the superior angles of the piece, and the third at the middle of the superior margin.

The *radial pieces* are large, longer than wide, and expand somewhat gradually from below upwards. The basal margin is obtusely angulated in the middle, and about half as long as one of the lateral margins. The sides are nearly plane and slope somewhat rapidly from the margins of the pseudo-ambulacro spaces to the lateral margins; below are two obtuse angular ridges, which start from the extremity of the pseudo-ambulacral fields and proceed to the infero-lateral angles of the piece. The surface is marked with rather prominent, uneven striæ, which run in lines nearly parallel with the lateral and inferior margins.

The pseudo-ambulacral areas each form an elevated, narrow, linear ridge, in the middle of a very large, triangular space, which is depressed and marked on each side of the area with closely arranged, lamellar, longitudinal striæ. The pore pieces are elegantly striated on their inner edges, and consist of two rows of alternating pieces to each field.

This fine species I found several years since in the shales at "Button-Mould Knob," seven miles south of Louisville, Kentucky. Its geological position is at the base of the Carboniferous System, in beds which are equivalent to the Encrinital Limestone of Missouri, Iowa and Illinois. It was found associated with *Actinocrinus Yandelli*, *Productus punctatus* and *Productus semireticulatus*.

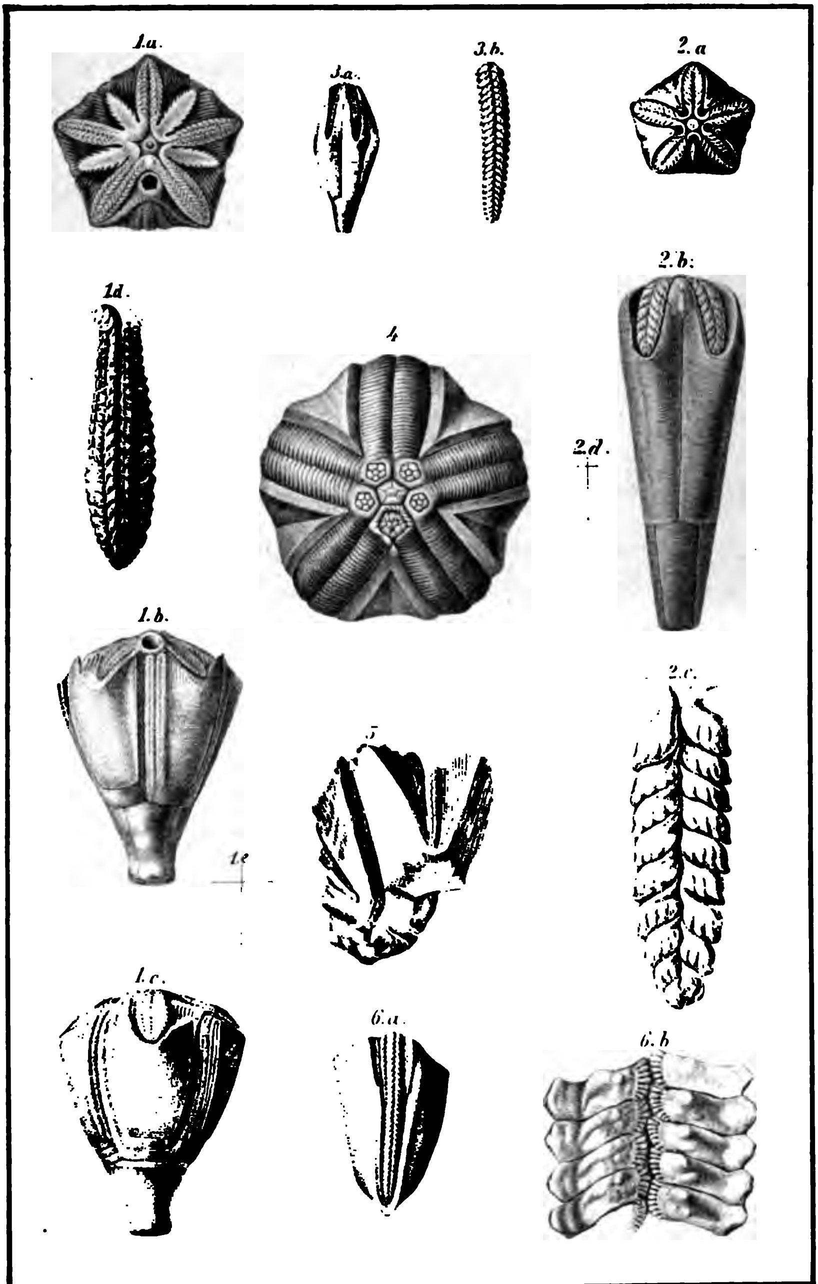
PENTREMITES GROSVENORI, *N. sp.*

(Pl. IX., fig. 2 a, b, c, d.)

The *body* of this elegant little Pentremite is clavate, very much elongated, with sides very gradually diverging, and the summit gently convex. The surface is covered with fine, closely arranged striæ, which are scarcely perceptible to the naked eye.

The *base* is slender, triangular-pyramidal, with the angles rounded. Its length is almost double the width and it occupies about one-third the total length. The under surface is triangular, slightly excavated, and the columnar facet small.

The *radial pieces* are very much elongated, subangulated in the middle, and flattened on the sides. Their branches diverge slightly and are very short, scarcely forming more than



1. *Codaster pyrimidatus, Shum.*
2. *Pentremites Grosvenori, Shum.*
3. " *lineatus, Shum.*
4. *Pentremites conoideus*, Hall.
5. " Kentuckyensis, Shum
6. " *decussatus*, Shu

Owing to the crushed state of the only specimen we have seen of this species the structure of the summit can not be further determined. From the same cause the figure represents the species much wider than natural.

Dimensions.—Length, 0.75; width, about 0.26; length of base, 0.25; width of same, about 0.13.

This Pentremite cannot be mistaken for any species hitherto found in our Carboniferous strata, but it is closely allied to *Pentremites Reinwardtii* (Troost), an Upper Silurian species from Tennessee. Our fossil is, however, more slender, and the pseudo-ambulacral fields reach down to the middle of the radial pieces, while in the *P. Reinwardtii* they extend only about one-fourth the length of these pieces.

For the opportunity of describing this rare species I am indebted to Henry M. Matthews, M.D., who has kindly placed it in my hands for this purpose. It was found in the Encrinital Limestone near Monmouth, Illinois, where it occurs with *Pentremites Norwoodii*, *Megistocrinus Evansi*, and *Actinocrinus pyriformis*.

PENTREMITES DECUSSATUS, *N. sp.*

(Pl. IX., fig. 6 a, b.)

We have had several radial plates of this species in our collection for a number of years, and although the locality where they occur has been frequently visited by collectors, no one, so far as we know, has been so fortunate as to find a perfect specimen.

The *radial plates* are large, rather thin, much elongated, and longitudinally arched. The basal margin is very short, incurved, and the lateral margins diverge at an angle of about 11°. The pseudo-ambulacral gutter extends to the base of the pieces. Below the middle it is narrow and deep, and the sides nearly parallel, but towards the summit it becomes shallow and increases in width; on either side is a well-defined angular carina, terminating below in a salient angle, which serves to support the extremity of the pseudo-ambulacral field. On the upper portion of the piece this carina is separated from the poral plates by a longitudinal groove. The sides are nearly flat and decline from the carina to the lateral margins, very abruptly for a short distance from the base, and then somewhat gradually. They are ornamented with distinct, rounded, transverse striæ, sometimes dichotomous, crossed by simple longitudinal striæ. These impart to the surface a peculiarly elegant decussate appearance.

The *pseudo-ambulacral* areas are very long, being continued almost to the base of the pieces. For some distance above the latter they are narrow and their sides nearly parallel; they then gradually widen until they arrive at the summit, where their width is twice as great as at the base. A deep, angular mesial furrow extends the whole length of the field, and on either side of this is a broad furrow, which coalesces with the sides before reaching the base. The fields consist of numerous pore and supplementary pore pieces, the former of which are transverse, gradually increase in width from below upwards, and extend the whole width of the field. They are somewhat wedge-shaped, their surface transversely excavated, and their inner extremities deeply and beautifully striated. The supplementary pore pieces are very short, arched above, and straight below.

This interesting species occurs at the base of the Carboniferous system at Button-Mould Knob, seven miles south of Louisville, Kentucky.

Observations on the Structure of the Summit of the Genus Pentremites.—In 1850, the writer, in connection with Dr. D. D. Owen, announced in the Jour. of the Acad. of Nat. Sci., Philad. (Vol. 2, p. 65), that the mouth and ovarial apertures, which we find at the summit of Pentremites, were, in the perfect state, completely closed by a conical covering of small calcareous plates. This announcement was, however, unaccompanied with any details of structure, as it was intended to publish a fuller account, illustrated with figures. But the specimen upon which our observations were founded was unfortunately mislaid, and, although hundreds of Pentremites have since been examined with the view of again detecting this structure, no example was found that exhibited it until a few days since.

During a recent visit to Cincinnati, the writer obtained, through the kindness of Mr. Samuel T. Carley, several specimens of *Pentremites conoideus* (Hall) from the Archimedes Limestone of Spergen Hill, Indiana, a species belonging to the group *Floreales* of Rœmer. After carefully cleaning these fossils, one of them was found to exhibit very clearly the structure represented in Pl. IX., fig. 4. The central stelliform space (mouth) is perfectly closed by six small microscopic plates, a central one of a pentagonal form, surrounded by five smaller pentagonal pieces, which unite with the edges of the aperture and form a little dome. The five ovarial openings are each, in like manner, closed, as represented in the figure, by six minute pentagonal plates, so arranged as to form a little elevation, which in its general appearance reminds one of the ovarian pyramid that we find in *Caryocrinus*, *Agelacrinus*, and other genera of the family *Cystidea.*

Since the above was written and the plate engraved, Prof. Swallow has liberally presented me with a specimen of *Pentremites sulcatus* (Rœmer) from Chester, Illinois, in which the summit openings are also completely closed; but the form of the covering pieces are quite unlike those of *P. conoideus*, and they are arranged in a very different manner. In this fossil there rises from the centre of the summit a little pyramid with five salient and five retreating angles, the salient angles being directly opposite the extremities of the interradial pieces, while the retreating angles correspond to the centre of the pseudo-ambulacral fields. The base of this little pyramid is joined to the superior edges of the pseudo-ambulacral fields so as to completely roof in the buccal and ovarial apertures. It consists of about fifty pieces, arranged in ten series; the first or exterior ones in each series being of a triangular form, the others elongated quadrilateral. Two series of pieces stand over each ovarial aperture, those of one side uniting with their fellows of the opposite side at the salient angles of the pyramid.

From these observations there would seem to be but little doubt that the summit openings are closed in all the forms of the genus Pentremites, whether they belong to the group *Floreales*, *Elliptici*, *Truncati*, or *Clavati*. This view is still further strengthened from the circumstance that the central opening has already been found closed in several species of the group *Elliptici*, namely, *P. Verneulii*, *P. Sayi*, *P. Norwoodii*, and *P. melo*.

TABLE OF GENERA AND SPECIES OF THE FAMILY BLASTOIDEA

Found in the Western and Southern Portions of the United States.

Genera and Species.	Synonyms and References.	Silurian Syst.: Lower Helderberg.	Devonian.: Upper Helderb'g.	Devonian.: Chemung Group.	Carboniferous.: Encrinital Limestone.	Carboniferous.: Archimedes Limestone.	Principal Localities.
PENTREMITES, *Say.*							
P. Godonii	*Kentucky Asterial Fossil*, Parkinson, 1808, Org. Rem., Vol. 2, p. 235, pl. 13, figs. 36, 37. *Encrina Godonii*, De France, 1818, Dict. Sci. Nat. T. 14. *Encrinites florealis*, Schlot., 1820, Pet. Got. *Pentremites florealis*, Say, 1822, Sow., Zool. Jour., Vol. 2, page 311, tab. 11, fig. 2—Troost, Tr. Geol. Soc. Penn., Vol. 1, p. 224, pl. 10, fig. 8. *Pentatrematites florealis*, Rœm., 1852, Monog. Blast., p. 33, tab. 1, fig. 1–4; tab. 2, fig. 8.					*	Hardin, Grayson and Muhlenberg Counties, Kentucky; Chester, Illinois; Mt. Sano, Alabama; St. Louis and Perry Counties, Missouri; Washington County, Arkansas.
P. pyriformis	Say, 1822, Jour. Acad. Nat. Sci. Phil., vol. 4, p. 294—Troost, Trans. Geol. Soc. Penn., Vol. 1, p. 288, pl. 10—Sowerby, Zool. Jour., Vol. 2, p. 315—Rœm. Monog. Blastoid., p. 84, T. 2, fig. 9 *a, b, c.*					*	Kentucky, Illinois, and Indiana; Mt. Sano, Alabama; Ste. Genevieve County, Missouri.
P. elongatus	Shum., 1855, Geol. Surv. of Missouri, 2d Rep., pt. 2, p. 187, pl. B, fig. 4.				*		Rocheport, & Columbia, Mo.; Burlington, Iowa; Monmouth, Ills.

Table of Genera and Species of the Family Blastoidea, etc. (Continued.)

Genera and Species.	Synonyms and References.	Silurian Syst.: Lower Helderberg.	Devonian.: Upper Helderb'g.	Devonian.: Chemung Group.	Carboniferous.: Encrinital Limestone.	Carboniferous.: Archimedes Limestone.	Principal Localities.
Pentremites, *Say*. (*Continued.*)							
P. lateriniformis	Ow. & Shum., 1850, Jour. Acad. Nat. Sci. Philad., Vol. 2, p. 66, pl. 7, fig. 15. *P. obliquatus*, Rœm., 1852, Monog. Blast., p. 47, T. 3, fig. 11 *a*, *b*.					*	Greenville, and Spergen Hill, Indiana; Ste. Genevieve and St. Louis Counties, Missouri.
P. sulcatus	Rœmer, 1852, *Pentatrematites sulcatus*, Monog. Blastoid., p. 34, T. 3, fig. 10 *a*—*c*.					*	Chester, Long Prairie, Ill.; Sparta, Crab Orchard, Tenn.; Mt. Sano, Alab.; Perry Co., Missouri.
P. (*new sp.*)	....	*					Birmingham, Missouri.
P. Koninckana	Hall, 1856, Ext. Tr. Albany Inst., Vol. 4.					*	Spergen Hill, & Bloomington, Ind.; Alton, Ills.
P. conoideus	Hall, Tr. Albany Inst., Vol. 4.					*	Spergen Hill, and Bloomington, Indiana; St. Louis Co., Mo.
P. granulatus	Rœmer, 1852, Mon. Blast., p. 43, T. 3, fig. 13. *Granatocrinus cidariformis*, Troost, 1849, List of Crinoids Tenn., Pro. Am. Ass. Camb. Meet., p. 62.				*		White's Creek Springs, Tennessee; Allen County, Kentucky; near Tuscumbia, Alabama.
P. Norwoodii	Ow. & Shum., 1850, Jour. Acad. Nat. Sci. Philad., N. Ser., Vol. 2, p. 64, pl. 7, fig. 13 *a*—*c*.				*		Oquawka, and Quincy, Illinois; Burlington, and Augusta, Iowa; Hannibal, and Clarke Co., Mo.

P. melo	Ow. & Shum., 1850, J. Ac. N. Sci. Phil., N. Ser., Vol. 2, p. 65, pl. 7, fig. 14 *a—c.*				*		Burlington, Augusta, Io.; Louisiana, Hannibal, Mo.; Monmouth, Ill.
P. (*new sp.*)	....				*		Callaway Co., Mo.
P. Sayi	Shum., 1855, 2d Rep. Geol. Surv. Missouri, pt. 2, p. 185, pl. B, fig. 1 *a—d.*				*		Boone, Marion, Jefferson, St. Louis and Ste. Genevieve Cos., Mo.
P. Rœmeri	Shum., 1855, 2d Rep. Geol. Survey Missouri, pt. 2, p. 186, pl. B, fig. 2 *a—d.*			*			Providence and Boone Counties, Missouri.
P. curtus	Shum., 1855, Geol. Surv. Mo., pt. 2, 2d Rep., p. 186, pl. B, fig. 3 *a—b.*					*	Fenton, St. Louis County, Missouri.
P. Verneuilii	*Olivanites Verneuilii*, Troost, 1849, List of Crin. Tenn. (Pro. Amer. Assoc. Camb. Meet.) p. 62. *Pentrem. Verneuilii* (Beadle), D'Orb. Pro. Pal., Vol. 1, p. 102.—*Elæacrinus Verneuilii*, Rœm., 1852, Monog. Blast., pt. 59, T. 5, fig. 1 *a—d.*		*				Falls of Ohio, and Charleston Landing, Indiana; Columbus, Ohio; near the mouth of Pine Creek, Iowa.
P. decussatus	Shum. (Described in this paper.)				*		"Button-Mould Knob," Kentucky.
P. Reinwardtii	Troost, Trans. Geol. Soc. Penn., Vol. 1, p. 224, pl. X. *Pentratrematites Reinwardtii*, Rœmer, 1852, Monog. Blast., p. 52, pl. 3, fig. 13 *a—c.*	*					Decatur County, Tennessee; Bear Grass Creek, near Louisville, Kentucky.
P. Grosvenori	Shum, 1857, Trans. Acad. Sci. St. Louis.					*	Spergen Hill, Floyd Co., Indiana.
P. lineatus	Shum. (Described in this paper.)				*		Monmouth, Illinois.
P. stelliformis	Ow. & Shum., 1850, Jour. Acad. Nat. Sci. Philad., New Ser., Vol. 2, p. 67, pl. 7, fig. 16 *a—b.*				*		Burlington, Iowa; Hannibal, Missouri; Monmouth, Illinois.
CODASTER, *McCoy.*							
C. pyramidatus	Shum. (Described in this paper.)		*		*		Falls of Ohio, Columbus.
C. Kentuckyensis	Shum. (Described in this paper.)						Button-Mould Knob, Kentucky.
C. Americanus	Shum. (Described in this paper.)		*				Falls of Ohio.
ELEUTHEROCRINUS, *Shum. & Yan.*							
E. Cassedayi	Shum. & Yan., 1856, Proceed. Acad. Nat. Sci. Phil., Vol, 8, p. 74, pl. 2, fig. 1—5.		*				Bear-Grass Creek, near Louisville, Kentucky.

EXPLANATION OF PLATE IX.

Fig. 1. CODASTER PYRAMIDATUS.

a—View of the summit.
b—Side view, showing the position of the anal aperture.
c—Another view of the side.
d—One of the pseudo-ambulacral fields greatly enlarged.
e—Natural size.

Fig. 2. PENTREMITES GROSVENORI.

a—Summit view.
b—View of the side.
c—Pseudo-ambulacral field, greatly magnified.
d—Represents the natural size.

Fig. 3. PENTREMITES LINEATUS.

a—Side view of a specimen, natural size.
b—Pseudo-ambulacral field, enlarged.

Fig. 4. PENTREMITES CONOIDEUS.

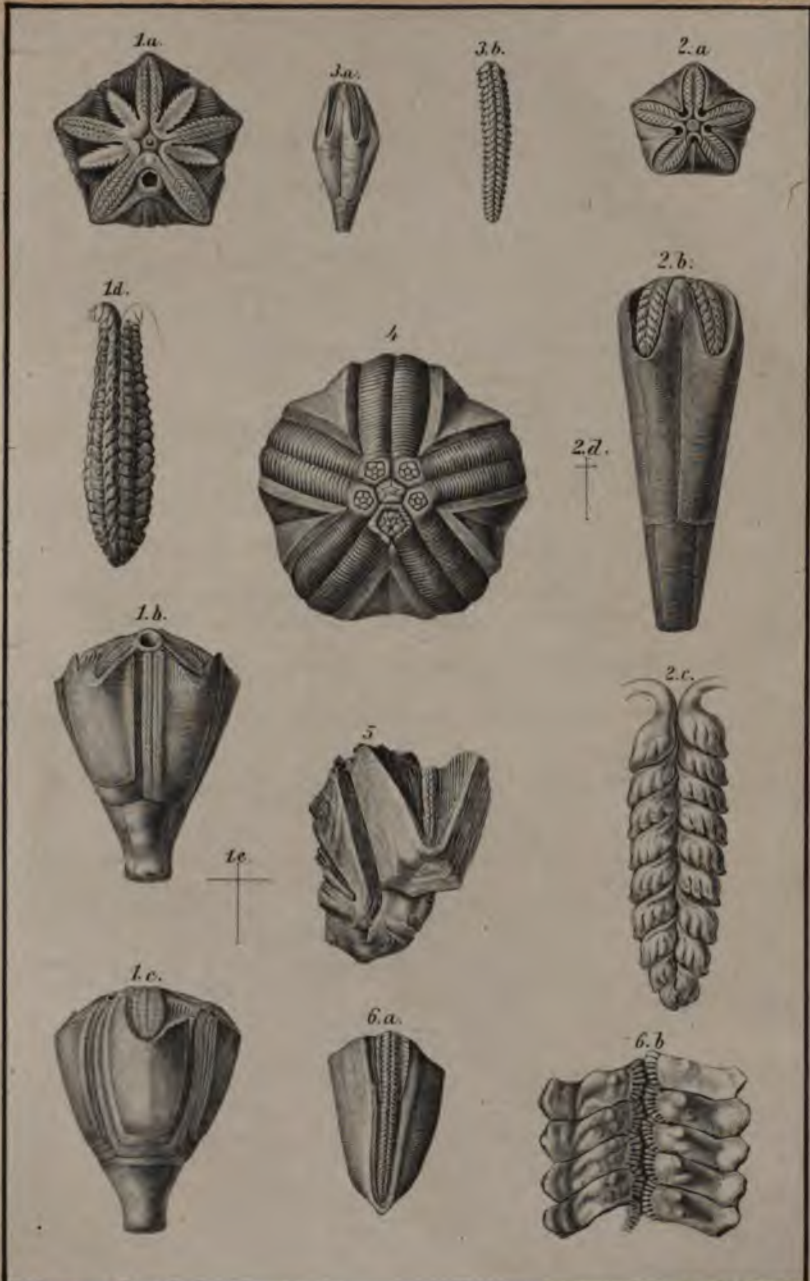
View of the summit, greatly magnified, showing the form and arrangement of the plates closing the mouth and ovarial openings.

Fig. 5. PENTREMITES (*Codaster*) KENTUCKYENSIS.

Fragment of calyx, consisting of two radial pieces and one basal, *natural size.*

Fig. 6. PENTREMITES DECUSSATUS.

a—Radial plate, *natural size.*
b—Upper part of pseudo-ambulacral field, greatly magnified, showing the form of the pore and supplementary pore pieces. The sutures separating the former from the latter have been omitted by the draughtsman.



Paulus Roetter del. St. Louis. L. Gast & Bro lith. St. Louis.

1. *Codaster pyrimidatus*, Shum.
2 *Pentremites Grosvenori*, Shum.
3. " *lineatus*, Shum.
4. *Pentremites conoideus*, Hall.
5. " *Kentuckyensis*, Shum.
6. " *decussatus*, Shum.

A Remarkable SEAL *in Dr. Abbott's Museum at New York, Explained by* G. SEYFFARTH, D.D.

Since the restoration of Egyptian Archæology, in 1799, more than 500 Egyptian hieroglyphic, or Hieratic, or Demotic Papyrus-scrolls have been brought to light, which harmonize, word for word, the one with the other, or, at least, contain the same parts of an original manuscript. Dr. Abbott's Museum, at New York, contains three Papyri of that kind, 22, 23 and 36 feet in length, respectively. A much larger one, brought from Thebæ to Paris, has been published by Cadet, and republished in the "Description de l'Égypte."* A Hieratic Papyrus nearly of the same length was in the collection of the late General Minutoli at Berlin, which is, at present, in England. The largest of all Papyrus-scrolls now extant, measuring 60 feet in length, and in the best condition, was acquired by Drovetti, the French Consul in Cairo, and sold, together with the rest of his collection, to the government of Turin, in 1823. It contains, in consequence of the smallness of the hieroglyphic figures, nearly the double of Cadet's manuscript.

All these Papyri contain, as Champollion conjectured, Egyptian Liturgies concerning the sepulture of the dead; wherefore he called them *Rituels funeraires.* Mr. Lepsius, on the contrary, although also unable to understand a single line of the *Rituels funeraires* according to Champollion's System, asserted that they contained an illustrated description of the Egyptian Metempsychosis, particularly of the transmigration of the soul mentioned in each Papyrus; which migration ended, after 3,000 years, with the return of that soul to a human body. Accordingly, Mr. Lepsius, publishing the Turin *Rituel funeraire*, called it "*Das Todtenbuch der Ægypter*"—The Book of the Dead—[Leipsic, 1842].

These learned dreams have vanished since the discovery of the key to the Egyptian literature, and since the translation of whole books and chapters of the so-called *Todtenbuch;* and thus was proved, what I first asserted in 1826, in my examination of the Berlin Papyri,† viz., that all manuscripts of that kind are copies of the ancient sacred records of the

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* Copie figurée d'un rouleau de papyrus trouvé à Thèbes dans un tombeau des rois, publiée par M. Cadet, Par. 1805. Description de l'Egypte, Anitiq. Vol. II. pl. 72.

† Bemerkungen ueber die Ægypt. Papyrus zu Berlin. Leip. 1826, pag. 10.

Egyptians enumerated by Clemens Alexandrinus,* and, according to historical traditions, written by Athothis, the son of Menes, the first king of Egypt, about 2781 B. C., 666 years after the Deluge. They are almost all ornamented with vignettes, sometimes colored, and even gilded; each chapter begins with a few red letters, like the manuscripts of the Copts and the Ethiopians; all the chapters and rows of letters are enclosed by vertical and horizontal lines. The argument of them, in general, is a religious consideration of the Creator and Governor of the world, of his ministers, the inferior deities, and of God's several works in heaven and on earth, to which ethical exhortations are commonly annexed.

All these sacred books of the Egyptians very often, after the name of God, i. e. Osiris (*osh-heri*, the most holy one), mention the name of the late owner, which was inserted by a later hand in all the places left blank for that purpose by the copier. In many such places, however, the later writer forgot to insert the owner's name; and therefore we find some places not filled up, in all such manuscripts.

As regards the supplying of the owner's name, the reason of it was the following:—The great quantity of such hymnic Papyri still in existence proves that nearly all the learned and pious men owned a copy, executed and sold by the holy writers in Egypt. After the owner's death, the priests, as Diodorus relates, assembled for judging him, and, first of all, hearing witnesses for or against the deceased. If he had been a righteous man and never committed crimes, the priests declared him to be a holy one; and then, it was believed, the soul of the late N. N. had gone to God, was reunited with him, and become a partaker of all the glory, power, and government of God. At the same time, one of the priests inserted the name of the late owner after that of Osiris; and thus, all hymns, referring before to Osiris alone, now referred, also, to his partaker, the late proprietor of the book, as the translations show.†

At last, the same Papyrus, in order to preserve it as long as possible, was enveloped, and pitched over, and thus deposited with the mummy in a catacomb. In that way, all the holy Mummy-scrolls have been preserved, which, since 1799, and in former times, have made their way from the silent graves to the now speaking Egyptian Museums.

The owner of the large Turin Papyrus-scroll, whose name is to be found in all the chapters, is indicated by the following letters:

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* Clem. Al. Strom. L. IV. chap. 4, pag. 757, ed. Sylb.

† See my "Summary of Recent Discoveries in Biblical Chronology, Universal History, and Egyptian Archæology, cet. New York, 1857," page 62.

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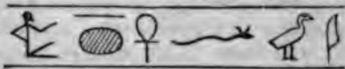


In many places, however, the hieroglyphics Nos. 5 and 6 are wanting, because No. 4, in consequence of its syllabic power, contained in itself the omitted letters (Nos. 5 and 6), as we shall see. The true pronunciation and explanation of that name depends, of course, on the true deciphering of each figure, and on a true hieroglyphic system. Mr. Lepsius, following Champollion, pronounced the name *Aufonch*. Such a name, however, is without analogy, and is pure nonsense when taken for an Egyptian word. He confounds vowels with consonants, and takes the crux ansata (No. 4) for an emblem of life, while it contains the name of a well-known goddess. In my Grammatica Ægyptiaca, based upon all the bilingual inscriptions and many translations of whole books and chapters, the key to the hieroglyphics and the true signication of all hieroglyphic figures are, I hope, sufficiently explained.*

No. 1, a leaf, sounds *a* in innumerable proper names, because its ancient name began with the sound *a*.

No. 2, a young bird, in Coptic *apoi*, but *hapoi* in the older Coptic, because the *h* became mute, as is the case in all languages; and *hapoi* corresponds with the Coptic *habi* (musca), *hbui* (parvulus avis), *hiptomai* (volare), and so on. Therefore, the said bird expressed, in the older monuments, the *h*, and only in later times it sounded *o* or *u*, e. g. in *Autocrator*, *Augustus*, and other Roman names.

No. 3, a serpent, called *hob*, *hof*, *hfo;* wherefore it very often expressed syllabically the letters *hb*, *hf*, and alphabetically the Coptic suffix *f*.

These three letters *ahf*, or *ahb*, give the word *ahab*, in the old Egyptian language; being nearly related to the Hebrew *ahab* (amare), in modern Coptic *hop* (to love, to marry), which is evidently a corruption of *ahab*.

No. 4, the so-called crux ansata, signifies the belly; in modern Coptic, *neki;* in the older, *aneki*, and is easily understood; for it stands very often, and even in our Papyrus, for the whole group, Nos. 4, 5 and 6, viz., *ank*. Consequently, it expressed alphabetically the *a*, syllabically *ank*.

No. 5, a line, used promiscuously with the zigzag, signifies the calm sea, while the zigzag represents the waving sea; in Coptic, *nun;* consequently, both signs signify the *n*, as innumerable proper names prove.

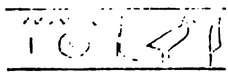
* Grammatica Ægyptiaca. Erste Anleitung zum Uebersetzen Ægyptischer Literaturwerke, nebst der Geschichte des Hieroglyphenschlüssels, mit 92 Seiten Lithographien. Gotha, 1855.

No. 6, the breast, *kibe*, sounds *k* in many proper names, e. g. in *kype* (camera). See Inscript. Rosettan. IV. 13.

No. 7, a sitting man; in Coptic, *esh;* in Hebrew, *ish.* We find it commonly annexed to the names of men, in order to distinguish the sexes; consequently, the owner of the Turin Papyrus was a man (*ish*).

Thus, then, the crux ansata, with or without the following line and breast, gives the letters *ank*, the name of the Goddess *Anuke*, the Egyptian Venus. For, a Greek inscription says: 'Ανούκει, τῇ καὶ Ἑστίᾳ, *cet.*, Θεοῖς μεγάλοις; i. e. "*To Anuke, being Vesta*, or Venus Urania, cet., *to the great deities*." * The same is proved by the ivory plate discovered by Layard in the ruins of Nineveh, representing on both sides Anuke; and there, that name is expressed by the crux ansata alone.†

The whole name of the late owner of the large Turin Papyrus, consequently, was not *Aufonch*, but *Ahab-Anuke;* i. e. the friend of the Goddess Anuke. Similar names, similarly compounded, were very frequent in Egypt. For instance, the said plate from the ruins of Nineveh, now in the British Museum, expresses the name of the king *Hophra*, in the time of Nebuchadnezzar, 585 B. C., by the following hieroglyphics:



The leaf and the young bird sound *ah*, as we have seen. The foot, in Coptic *pat*, standing for the snake in the Turin Papyrus, signifies *p* or *b*, because its name begins with that sound; consequently, the whole group expresses the same word, *ahab* (friend). The zigzag *n* is a mark of the genetive; the pupil, in Coptic *hra*, in Hebrew *raah* (videre), signifies *Hra* and *Ra*, the sun; and the boundary-stone, *wot* or *pot*, is the Coptic article, which, in the ancient Coptic, stood not before, but after, substantives. As the article and the mark of the genitive were often left out, the Egyptians called this king *Ahap-Hra*, or, shorter, *Hophra*, like the Hebrews, the *Apries* of Herodotus, the *Ephre* in the Vulgata, i. e. "the friend of Hra," or the Sun-God. Of a similar composition are the names of the kings: *Moeris*, i. e. *mai-Ra*, the beloved of the Sun-God; *Memnon*, i. e. *mai-Amon*, the beloved of the God Amon; *Osi-ma-n-pthah* (Osimanthya), i. e. *mai-n-Phtha*, the beloved of the God Phtha; and so on.

The question now is, who may that *Ahab-Anuke*, the owner of the largest Egyptian Papyrus-scroll, have been? In

* Letronne, Recherches, cet., No. XXXII. p. 344.

† Layard, Nineveh, pl. XXII.

what city, and in what time, did he live? What was his office, and what his caste? The Papyrus itself says nothing about it. From the said determinative *esh*, we learn only that he was a man; and the added words, *moshi mashi* (justus justificatus), testify that Ahabanuke was then dead, and already justified by the judgment of the dead. Besides, in some places of the Papyrus, it is said that his mother was the "*sheri Phamini*, i. e. the daughter of Phamini; a common name in Egypt, which occurs also in the Greek-Egyptian mummy-chest at Berlin. This is all we know, and nobody can tell us what was the condition of Ahabanuke, nor where and when that remarkable manuscript was written. Notwithstanding, all these questions are very important for deeper historical researches; for, as all the copies of the sacred Egyptian records differ, in many places, the one from the other, sooner or later the question will be asked, which of the different readings is the genuine one, and to what country and age does the Turin Papyrus, and similar ones, belong? The only probability is, that this costly manuscript was the property of a rich and distinguished person, and that it originated many hundred years later than Mr. Lepsius supposed; for, a Papyrus-scroll, sixty feet long, with more than 30,000 hieroglyphics and many vignettes, the translation of which alone would fill a quarto volume, was, in that time, a very valuable treasure, accessible only to rich men, or people of the highest rank. Regarding its age, it is clear that a manuscript of that character, and in so small letters and so perfect a state of preservation, must be many hundred years younger than those of the XVIII. and XIX. Dyn. (1900 and 1600 B. C.), which bear marks of much greater antiquity. In short, for more than forty years we have been ignorant of all the essential particulars concerning the greatest monument of Egyptian Literature yet in existence; and therefore it would be interesting to discover an inscription, by means of which the foregoing questions might be answered.

It is a curious fact, that our own country, many thousand miles distant from old Egypt, possesses such a memorial of antiquity as the seal of the same Ahabanuke, preserved in the Egyptian Museum of Dr. Abbott in New York; and to this I take the liberty of calling attention.

The use of seals is very ancient. We read in Gen. xli. 42: "And Pharaoh (2092 B. C.) took off his ring from his hand, and put it upon Joseph's hand." The greater number of the Egyptian signet-stones were formed out of porcelain-clay, and shaped like beetles or Scarabæi of all sizes, of which more than 5,000 (a few of them with their gold or silver settings) are to be found in the Egyptian Museums, and nearly 2500 have been copied by myself. The Egyptian Scarabæi

EXPLANATION OF PLATE IX.

Fig. 1. CODASTER PYRAMIDATUS.

a—View of the summit.
b—Side view, showing the position of the anal aperture.
c—Another view of the side.
d—One of the pseudo-ambulacral fields greatly enlarged.
e—Natural size.

Fig. 2. PENTREMITES GROSVENORI.

a—Summit view.
b—View of the side.
c—Pseudo-ambulacral field, greatly magnified.
d—Represents the natural size.

Fig. 3. PENTREMITES LINEATUS.

a—Side view of a specimen, natural size.
b—Pseudo-ambulacral field, enlarged.

Fig. 4. PENTREMITES CONOIDEUS.

View of the summit, greatly magnified, showing the form and arrangement of the plates closing the mouth and ovarial openings.

Fig. 5. PENTREMITES (*Codaster*) KENTUCKYENSIS.

Fragment of calyx, consisting of two radial pieces and one basal, *natural size.*

Fig. 6. PENTREMITES DECUSSATUS.

a—Radial plate, *natural size.*
b—Upper part of pseudo-ambulacral field, greatly magnified, showing the form of the pore and supplementary pore pieces. The sutures separating the former from the latter have been omitted by the draughtsman.

No. 9, the Egyptian axe, the Coptic *hater*, *ather*, and shorter, *tor*, *tori* (axe), which is often expressed by the figures *axe* (=*h*), *mount* (=*t*), and *mouth* (=*r*), is the syllabic sign for the same consonants *htr*, and signifies in all bilingual inscriptions Θεός (God); the Coptic, *hetor;* the Hebrew, *adir* (the Almighty, the Creator, the mighty God). Thus, then, Phtha is called the mighty God (*wot hetor*), and he belonged indeed, according to Herodotus and others, to the highest class of deities, the seven Cabiri, God's ministers.

Nos. 10, 11, 12, and 13, correspond exactly, as we have seen, with the name of the proprietor of the Turin "Book of the Dead," the said *Ahab-Anuke* (the friend of Anuke). Mr. Oswald, neglectful of grammatical studies, translated it *Macrobius;* and the *Aufonch* of Mr. Lepsius is a similar chimera.

No. 14, a sitting man with a whip or scourge in his hands; in Coptic, *ham-biki* (homo flagelli, or flagellifer). The whip, *biki*, expresses all the words containing the same consonants; consequently, also, the Coptic, *bôk* (servus). Therefore, the man with the whip expresses syllabically *ham-bok* (homo serviens, minister).‡ Ahabanuke, then, calls himself a servant-man, or minister. In his Turin Papyrus-scroll he is called only *esh* (vir), because he was then dead. It was enough, there, to distinguish the sex. Champollion took the bearer of the whip for a symbol of a king, probably because kings reign holding a whip in their hands. Nor did I ever hear of an Egyptian king called *Ahabanuke*, as Champollion's whipping king would require.

No. 15, the crown, already explained, alphabetically expresses both *n*, the genitive, and the preposition *in;* the Coptic *n*, *en*, and *hen* (in).

No. 16, the plan of a house, in Coptic *ahe*, very often expresses the letters *ahe*, in Coptic *ohe* (abode, mansion, house), e. g. in the bilingual inscriptions.§

No. 17, the landmark, called in Coptic *woti*, in Hebrew *boti* (separatio), signifies syllabically *wt* in the word *wot* (one), the old *pot*, *hopt;* and therefore alphabetically *p*, the article *the*, which in the old Egyptian language always follows the substantives.

The substance of the first part of the inscription, then, is, that Ahabanuke, the chief of the slaughtering priests, belonging to the temple of Phtha, served in the house of another. The following hieroglyphics, of course, must contain a proper name, viz., that of a king, because the whole inscription is surrounded by a royal cartouche (No. 25), which always, as

‡ The same signification of the man holding a whip is obvious in many other places; e. g. in the Todtenbuch, Tab. I., Tit. Comp. my Theolog. Schriften, p. 1.

§ Inscript. Rosett. XIII. 14; XIV. 82. Obelisc. Flamin. III. 6.

we learned first from the Inscription of Rosetta, and the Roman Obelisk translated by Hermapion, includes royal names. The so-called cartouche, however, is rather the Egyptian ark or shrine, in Coptic *ran*, in Hebrew *aron*, and therefore not at all a symbolic sign, as Champollion supposed, but the Coptic word *ran* (nomen, proper name) being syllabically expressed.

Nos. 18 and 19, a grinding-stone and the sparrow-hawk, the latter ornamented with the royal insignia. The grinding-stone, or muller, derived from the Coptic *shote* (concidere), and related to the Coptic *shote* (farina), expresses the letters *st* in the names of the Demi-gods *Set*, *Sothis*, in the word *saat* (transire), and similars; consequently, all the words and proper names of the same composition. The sparrow-hawk, with the royal insignia, in the bilingual inscription of Philæ and the Flaminian Obelisk at Rome, is translated by βασιλεὺς (king), and Ὧρος (Horus, Apollo), from the root *uro* (king). Many copies of the Egyptian sacred records put, instead of the sparrow-hawk, the letters *kr* (wax and mouth), which give the old name of *uro* (king).‖ For, it is evident that all these words *uro*, *Horus*, the Latin *herus*, the German *Herr*, the Greek κύριος, the Persian *khur*, (the sun), the Persian king *Cyrus*, the Old Egyptian *kur* or *kor*, originated from the same primitive root, probably from the Hebrew *kabar*, *gabar*, contracted *kur*, *gur* (to be powerful, to govern), and that in later times the *k* changed into *g* and *h* and *h* mute. In short, the sparrow-hawk signified the Coptic *uro*, or *huro* (the king), whence the name *P-haraoh*, i. e. *huro*, being augmented by the article *P*, was derived. The same signification of the sparrow-hawk is proved by its insignia, the crown and the whip, which served for diacritical marks. For the Egyptian crown (*neb*) signifies alphabetically the Coptic *neb* (dominus); and the whip, *biki* (flagellum), expresses syllabically *bk*, i. e. the Coptic *bŏk*, which, according to Josephus, signified (sacratiori Ægyptiorum lingua) the word *king*.* Consequently, the hieroglyphics, muller and sparrow-hawk, with their determinatives, contain the name of a king, *Set*, or, with the Greek termination, *Sethos* and *Sethon*. Manetho and Herodotus mention two kings of that name, the one belonging to the XIX., the other to the XXIII. Dynasty of Manetho. There existed also a city in Lower Egypt, near Pelusium, called *Sethron;* which name contains exactly all the consonants expressed by the muller and the sparrow-hawk, viz., *Set* and *Hor*. The question, however, is, to what Dynasty this king *Set*, or *Sethro*, belonged, in whose palace Ahabanuke, the

‖ See my Grammatica Ægypt. p. 69, No. 301.

* Josephus, Contra Ap. I. 14; II. 445.

high-priest of Phtha, was employed. To that question we shall return hereafter.

No. 20, a line, and its frequent substitute, the zigzag, represents, as we have seen, both the calm and the waving sea, in Coptic *nun*, and expresses alphabetically *n*, the sign of the genitive.

No. 21 is a baking-dish without dough (comp. No. 3), or wicker basket, as its carefully executed representations, e. g. the mosaic hieroglyphics in a Turin sarcophagus show; and therefore its name was *nub-t* (complexum opus), and its syllabic pronunciation *nb*. Thus it expressed in the bilingual inscriptions the Coptic words *nibi*, *niben*, *nim* (omnis), as well as *nib*, *nêb* (dominus), and similar words.†

No. 22 and 23, a mount and a chain of mountains. The former, called in Coptic *tow* (mons), expresses syllabically *tw*, *tb*, *tp*; e. g. in the words *towe* (parentes), *top* (consuetudo), *towe* (mane), as the bilingual inscriptions prove, and especially in that frequent group *tubo* (purus, mundus), the word *tubo* being related to *tabteb* (ornatus, mundus).‡ The chain of mountains, in Coptic *kôôbe*, expresses syllabically *kb*, particularly in the group in question, *keb* (duplex), and consequently, together with the preceding mount, the words *tubo keb* (both worlds), viz., Upper and Lower Egypt. From the Rosetta-stone it is known that Egypt, being formerly divided into two parts, was frequently called *the upper and lower land* (ἡ ἄνω καὶ κάτω χώρα). For the same reason, the writers very often put two mounts instead of one in the same group. The whole is translated by Hermapion ἡ οἰκουμένη, i. e. the whole world of Egypt.§ Thus, then, the said king is called "the Lord of both Egypts." For the rest, we often find one or two mounts after the chain of mountains, and that reading gives the same but transposed words *keb tubo*, or *keb tubo tubo* (uterque mundus), instead of *tubo tubo keb* (mundus uterque).

No. 24, a composition of four hieroglyphics, viz., an ostrich feather, a mount, a kind of stool, and a vase, of which the two latter serve as diacritic signs. The ostrich feather very often stands for the cubit, in Coptic *mashi*; and the bilingual inscriptions translate it by ἀνήκοντα, in Coptic *mashi* (justa), or by ἱερόν, in Coptic *mashi*;† wherefore its syllabic pronunciation was *msh*, and its signification *mesh* (plenitudo), when united with the mount, *tubo* (the world). Consequently, the ostrich feather and the mount give the words *mesh tubo*

† Inscript. Rosett. VIII. 7; IX. 2; XI. 47, 60. Obelisc. Flamin. I Pied. I. *a*, II. *a*, III. Pied.

‡ Inscriptio Phil. L. I. Inscript. Rosett. II. 12. Todtenbuch, Tab. V. No. 90.

§ Obelisc. Flam. II. *a*, and in other places.

(plenitudo terræ), the fullness of the world (of Egypt). The stool, or instrument for elevating and distinguishing objects placed upon it, is pronounced *mini*, in the proper name, Phaminis, on the bilingual Berlin mummy-chest; wherefore it belongs to the root *maini* (insignire), to render more visible, or distinguished. This hieroglyphic figure, then, expressing the consonants *mn*, gives, in that composition, the word *mone* (mansio, habitatio), and serves as a determinative to express the idea, that Egypt was the abode, or home, of mankind. Finally, the joined vase, called *shashu*, being translated ὀψώνιον (in Coptic *shesh*), and *byssus* (in Coptic *shesh*), and *meal* (in Coptic *shaish*),‡ expresses syllabically the two consonants *sh-sh*, and consequently, in the composition in question, the word *shesh* (extensio, or extending). Therefore the whole group contains the words *mesh tubo mone shesh*, i. e. the fullness of the world, the extending home (of mankind). The two last determinations, which are sometimes wanting in the same group, were added in order to explain the preceding hieroglyphics, and to prevent misunderstanding. Messrs. Champollion and Oswald translate the last groups thus: "Osiris, the Lord of the West." And, indeed, they sometimes do signify *the West*, because the ostrich feather expressing *msh*, gives also the word *mashi* (Occidens); but, here, such a translation is nonsense. Or, can it be proved that the Egyptians adored four different Osirises (the most holy ones), the first residing in the East, the second in the South, the third in the West, and the fourth in the North? And where in the whole inscription, Osiris being constantly expressed by an *eye* and a *throne*, is Mr. Oswald's Osiris mentioned?

The whole of that inscription contains, then, the following letters and words: "*Wot kara shot en Ptah, wot hetor, Ahabanuke, hambok en ahe pe Set-hur, nēb, bok, ran, en nēb tuba kēb, mesh tubo, mone shesh;*" of which this is a translation: "*The chief of the* (priests) *slaughtering victims, of Phtha, the great God: Ahabanuke, the minister in the palace, namely, of Set, the king, the lord, the sovereign, the prince of the two kingdoms, and of the fullness of the world* (of Egypt), *the extending home* (of mankind).

At last, it will be asked, what literary advantages may we derive from that inscription? They are, indeed, greater than could be expected from so small an Egyptian stamp; for,

1. Till now, the particulars of all the persons referred to in the copies of the Egyptian sacred records, and even that of the late owner of the largest Papyrus-scroll existing, were enveloped in impenetrable darkness. But now we know that

† Inscript. Ros. III. 4; XI. 18.

‡ Inscript. Rosett. X. 41. Todtenbuch 71, 1; 106, 1; 128, 4.

this Ahabanuke (the friend of the Goddess Anuke) was the head of the first class of priests in the temple of Phtha, and that the said Turin Papyrus was once in the hands of a very distinguished person of the ancient world. For, according to Clemens of Alexandria,* Diodorus of Sicily, and others, the Egyptian priests were divided into very different classes; and their chief was a high-priest, like the high-priest of the Hebrews, the head of all the slaughtering priests, of all the Levites and their classes, and of all the Nethinim. This Ahabanuke was, moreover, a minister in the house of the king Set.

Hence we may conclude, that the large Turin Papyrus-scroll, being written for the use of so mighty and distinguished a person, was copied by the hand of a very learned scribe, and with the greatest accuracy, and that it must contain the most reliable readings. The said Papyrus is, at present, the only manuscript of the Egyptian sacred records from which we know anything of the biography of its former owner, viz., his caste, his rank, his office, his king, and, as we shall see directly, his place in Egyptian history.

2. From the same seal of Ahabanuke, we learn further that the Turin Papyrus in question belongs to the class of Memphitic manuscripts; for the owner was the high-priest of Phtha, whose great temple stood in Memphis, the second capital of Egypt after the union of both kingdoms, Upper and Lower Egypt, under Pharaoh Amos, the first king of the XVIII. Dyn., in the time of Moses, (1904 B. C.) Concerning the temple of Phtha, the Rosettana says: "The priests resolved to put the golden crown (of Ptolemæus Epiphanes) in the midst, with which crown the illustrious king entered the temple of Phtha, in order to perform the usual ceremonies prescribed for a king entering upon the government."† Further, Suidas says: Φθᾶς, Ἥφαιστος παρὰ Μεμφίταις (Phtha is the Vulcanus in Memphis). And even the capital, Memphis, obtained its name from its great temple of Phtha, because that name consists of the words *mone Phtha* (the dwelling of Phtha). Moreover, as Ahabanuke was the minister of the king Set, and all dynasties since the XVIII. (particularly that of Set) resided at Memphis, it follows that a Papyrus-scroll written for the use of a minister in the house of a Memphitic king, and at the same time a high-priest in a Memphitic temple, must be a Memphitic manuscript. Thus, then, the Turin Book of the Dead is the first copy of the sacred Egyptian records of which the place of origin is demonstrated, and that fact is a useful one; for, in comparing a great many of such copies in different Museums, particularly at Berlin, the one with the other, and word for word, for the purpose of making

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* Clemens Alexandrin. Strom. VI. 4, Sylb.

† Inscript. Rosett. XI. 12. See my Theologische Schriften cet. p. 65.

out the genuine readings, I discovered that all those Papyri contain a great many discrepancies, and that they originated from two different redactions of the original text, being executed, the one in Thebes, the other in Memphis, the two Egyptian capitals.‡ Sooner or later, it will be a problem to reëstablish the genuine text of the very ancient holy books of the Egyptians; and for that purpose it must first of all be decided to what redaction the single manuscripts of that kind belong. As Thebes, where Athothis, the author of the sacred Egyptian books, 700 years after the Deluge, lived, was the Egyptian capital, 800 years before Memphis, and as that city was the first residence of priests and sciences, it is evident that the Thebaic redaction of those books, and not the Memphitic copies, deserve preference. In the same way, the original text of the New Testament was reëstablished; for the Critics, first of all, divided the manuscripts into different classes according to their countries; and then, on the ground of the different local redactions, the genuine readings were restored.

3. Finally, the seal of Ahabanuke brings to light in what time its owner lived, and in what age the great manuscript of Turin was written. The king, whose minister Ahabanuke was, is called *Set*, or *Set-huro*, and Manetho's Catalogue contains two different kings of that name, viz., the first king of the XIX. Dyn., *Sethos*, and the last king of the XXIII. Dyn., *Zet*. As the Greek *z* sounded like *s* in later times, there is no difference between *Set* and *Zet*; and even Herodotus (II. 141) pronounces the *Zet*, the last king of the XXIII. Dyn., correctly: *Sethos*. The age of *Set*, or *Sethos* I., is determined by the Nativity, or planetary configuration in the year of birth, of that king, represented on his grand sarcophagus in the British Museum, called formerly the Sarcophagus of Alexander the Great, which was preserved in a Mahometan mosque in Cairo, and after the battle near Abukir was brought to London.§ According to the said astronomical observations, *Sethos*, the first king of the XIX. Dyn., was born in 1681 B. C., and consequently his government must have begun about 1600 B. C. The same is proved by several Nativities of the preceding Pharaohs, and other astronomical observations made during the XVIII. and previous Dynasties, which concern the years 1698, 1731, 1882, 1904, 1951, 2555, and 2781 B. C.† Supposing Sethos, mentioned in the seal of

‡ See my Bemerkungen ueber die Berliner Papyrusrollen. Leips. 1826, pag. 7.

§ See my Astronomia Ægyptiaca, cet., Leip. 1833, p. 253; and a *fac simile* of the Astronomical Inscriptions, Tab. V. *a*, *b*.

† See my Astronomia Ægypt. cet. Leips. 1833; and Berichtigungen der alten Geschichte cet. Leips. 1855.

Ahabanuke, to be the Sethos of the XIX. Dyn., whom Syncellus, according to the Vetus Chronicon, calls *Thu-oris*,* the large Turin Papyrus and the seal in question belonged to the year 1600 B. C. But the name of Sethos, on his London Sarcophagus and other monuments, is expressed by other hieroglyphics than it is in the seal of Ahabanuke, viz., by the *arm holding a club*, and by the *sparrow-hawk*. The arm with a club, equivalent to the man holding a club, signifies *shôt*, or *shot* (violenter agere, cædere, vulnerare), and expresses the consonants *sht*, or *st*; consequently, also *Set*, or *Sethos*, or, with the sparrow-hawk, *Set-hro*. As the arm with the club, however, signifies also *hite* (ferire), and in many words the consonants *ht* and *t*, the said king could also be pronounced *Thuoris*, as Syncellus, or rather the Vetus Chronicon did; and it is known that the written names of many Egyptian kings were differently pronounced, e. g. *Amos* or *Thuthmos*, the first of the XVIII. Dyn., in consequence of the different names of the same hieroglyphic figures. Now, as the name of King *Sethos*, on the seal of Ahabanuke, is expressed not by the arm with a club, but by the grinding-stone, we must conclude that the latter belonged to the XXIII. Dyn., namely, to Manetho's *Zet*, the *Sethos* of Herodotus (II. 141).

The question now, is, in what time Sethos II. reigned. It is a pity that, in consequence of corrupted ciphers, the chronologies of Manetho, Julius Africanus, Eusebius, the Armenian translation, and the Vetus Chronicon, regarding the governments of the XIX., XX., XXI., XXII. and XXIII. Dynasties and their single kings, differ very much the one from the other; notwithstanding, it is possible, by means of those astronomical observations concerning the XIX. and XVIII. Dyn., to determine very nearly the time of Sethos II., the last king of the XXIII. Dyn. Manetho and his copiers mention the following longer and shorter periods:

Dyn. XIX.	209 years	(or 194).
Dyn. XX.	178 "	(or 185).
Dyn. XXI.	180 "	(or 121, or 114).
Dyn. XXII.	148 "	(or 120, or 89, or 44).
Dyn. XXIII.	89 "	(or 44, or 84).
Total	754 years.	

As Sethos I. was born 1631 B. C., and reigned about 1600 B. C., Sethos II., the last king of the XXIII. Dyn., seems to have reigned 846 B. C. Africanus, however, gives 67 years only to the six anonymi kings of the XXII. Dyn., while in general every king of that period reigned nearly 25 years; wherefore we may add a hundred years to those 754 years,

* Syncell. Chronogr. p. 155, ed. Ven.

and thus bring Sethos II. down to about the year 746 B. C. It is probable that the copiers of Manetho's history, taking together the governments of the three first anonymi kings of the XXII. Dyn., wrote 25 years instead of 75 years; and, taking together the government of the three last Anonymi since Takellothis, put 42 instead of 92 years. In that case the succession of the nine kings of the XXII, Dyn. was the following:

DYNASTY XXII. WITH NINE KINGS.

1. Sesonchis, or Sesonchosis	21	years.
2. Osoroth, or Osorton	15	"
3., 4., 5. Anonymi, together (25)	75	"
6. Takellothis	13	"
7., 8., 9. Anonymi, together (42)	92	"
Total	216	years.

That correction, at least, harmonizes with Herodotus (II. 141), who says that Sethos II., being before a priest of Phtha at Memphis, once defeated Sennacherib, the king of Assyria, near Pelusium, perhaps the ancient Sethron. The same Sennacherib, as is related in 2 Kings xviii. 14, besieged Jerusalem in the 14th year of Hezekiah, who reigned since 726 B. C. Consequently, Sethos II., who reigned 31 years, was contemporary with Sennacherib and Hezekiah, about 750 B. C.

Another calculation, based upon a Biblical relation, brings Sethos II. down to the same time; for it is stated, 1 Kings xiv. 25, and 2 Chron. xii. 2, that in the fifth year of Rehoboam, who reigned since 950 B. C.,* consequently in the year 945 B. C., Jerusalem was taken by a Pharaoh *Shishak*. All Chronologers, before the restoration of the Egyptian Archæology, supposed, despite the chronological discrepancies, the Biblical Shishak to be the first king of the XXII. Dyn., Manetho's *Sesonchis*, or *Sesonchosis*, no other king of that name being yet known. The monuments, however, mention two kings of that name, and distinguish them by their titular or sacred names, which always precede the vulgar names of the kings. It is known that nearly all the Egyptian inscriptions, mentioning a king, give first his sacred name and then his vulgar name; which was necessary, because many Egyptian kings obtained the same vulgar name, e. g. that of *Amos*, *Ramses*, *Thuthmos*, and so on; who were, of course, to be distinguished by their sacred names. On the other hand, we find in the monuments equal royal sacred names being joined to different royal vulgar names; of which the following was

* See my Chronologia Sacra, p. 258; and Summary of Recent Discoveries in Biblical Chronology, cet., p. 217.

the reason. Many ancient kings, father and son, reigned together, as the history of all nations shows, and in such cases in Egypt the sacred name belonged to both father and son. Now, the Egyptian monuments mention two *Shishaks*, being distinguished by their sacred names. That of the older *Shishak* is expressed by the hieroglyphics *pupil, head of fox*, and *byssus-bunch;* while the sacred name of the later *Shishak* consists of the hieroglyphics *pupil, crown*, and *beetle*. The whole name is this:

VULGAR NAME. SACRED NAME.

Further, the same sacred name in other monuments precedes the vulgar name of King *Takellothis*, the sixth of the XXII. Dyn., as we have seen. Consequently, another and younger *Shishak* reigned together with *Takellothis;* therefore the succession of the last Pharaohs of the XXII. Dyn. was the following:

6. *Takellothis* .... 13 years.
7. *Shishak* II. }
8. *Anonymus*, } together .... 92 "
9. *Anonymus*, }
Dynasty XXIII. till *Zet*, or *Sethos* .... 89 "

Total....194 years.

As then a Pharaoh *Shishak* took Jerusalem in the fifth year of Rehoboam, i. e. 945 B. C., it is evident, again, that the Sethos II. who reigned 194 years after *Takellothis*, the co-regent of *Shishak* II., must have governed about 750 B. C. A more exact chronology of that time is impossible, because the ciphers in Manetho's copiers differ too much the one from the other.

From this succession of the Pharaohs in the XXII. Dyn. we also learn, that the Pharaoh whose daughter Solomon married was probably the said King *Takellothis*, the father of *Shishak* II.

Thus we arrive at the well-founded conclusion, that the high-priest Ahabanuke lived about 750 B. C. To that same time belong many Egyptian monuments, e. g. the costly Granite Sarcophagus in the British Museum, No. 23, containing the Nativity of a Memphitic priest, in the year 787 B. C., March 29th; the great Granite Sarcophagus at Vienna, containing the Nativity of a priest in 661 B. C., Dec. 29th; and the Granite Sarcophagus in the British Museum, No. 3, containing the Nativity of a priest in 631 B. C., Dec. 27th.* In

* See my Berichtigungen der alten Geschichte, pp. 157, 169, 174.

short, Ahabanuke was a cotemporary of *Romulus* and *Remus;* of the Hebrew kings *Uzziah, Jotham, Pekahiah,* and *Pekah;* of the Assyrian *Sennacherib;* and of the Prophets *Hosea, Isaiah, Nahum, Michah, Obadiah,* and *Habakkuk.*

At the same time, we now see that the seal of Ahabanuke and the famous Turin Todtenbuch do not belong to the XVI., or XV., or XIV. century B. C., but, as its character, condition, and state of preservation confirm, to about the year 750 B. C. That manuscript is the first copy of the Egyptian sacred books, of which the age is made out; and with its aid it is now possible to determine the ages of coëval, or younger, or older Papyrus-scrolls, as is the case with the Greek and Roman manuscripts. The seal of Ahabanuke, in New-York, is, as yet, the only monument containing the name of Pharaoh *Sethos* II., being mentioned by Manetho and praised by Herodotus.

Second Series of Descriptions of Bryozoa *from the Palæozoic Rocks of the Western States and Territories.*

BY H. A. PROUT, M.D.

Coscinium (*Keyserling*).

Lobed expansions in the form of a leaf, consisting of two mutually applied strata, whose free planes exhibit free pores quincuncially arranged, so that on the cross-fracture of the leaf are seen the tubular oblique cells, biserially distributed on either side, quite the same as in *Eschara;* but here the foliaceous expansion is perforated by regular series of holes, as in *Adeona cribriformis,* from which, however, it varies by the want of an articulated stripe. These expansions, as it appears, originate from densely cellular ramified pedicles, identical with the structure of *Eschara,* and are characterized only by their great thickness. Our genus coincides with *Eschara,* also, in the character of the intercellular substance, which is permeated with capillary tubuli; this substance fills up, with age, the holes likewise, which are then distinguished as spaces without cells. If in *Anthozoa* we avail ourselves of the manner of propagation as a criterion for generic distinctions, we may here likewise consider as a new genus the forms which, while otherwise completely coinciding with *Eschara* by the regular holes in the leaf or foil, indicate a rythmical cessation of gemmation in the cell series. The interesting *Gorgonia proava* (Eich. Urwelt, H2, p. 44, tab. 1, fig. 5), from Silurian limestone, seems to belong to this genus.

We quote here the generic characters of *Coscinium* from Keyserling's original description, with the view of presenting some further details in the organization of this Bryozoa, which were probably not so manifest in the specimens upon which he founded the genus.

The two strata or surface plates are not invariably separated by a thin lamella, but even on the leaf-like expansions of the corrallum, where this character is in general best preserved, we find them sometimes for considerable spaces so completely welded together, or solidified, that the mesial or divisional plate cannot be recognized. Where the dividing plate is more fully seen it has a cancellous structure on either side, from the outer cellules of which the large oblique cells terminating on the free surface take their rise. This divisional plate is sometimes separated by the development of its own internal cell structure, so as to form two, or even more divisional lamellæ. In one cross-fracture where the outer tables had been separated several millimetres apart, there was the appearance of three lamellæ, interrupted and dislocated by excessive cell development.

This development of the intercellular spaces sometimes separates the outer tables to the distance of three or four millimetres, or even more, in which case the cancellous structure and the middle lamina sometimes decay, so as to leave intervals or hollow spaces between them; this change was observed in a portion of the very thickened, sinuous, and angularly contorted plates near the base of the polypidom. It would seem in the regular development of the larger cells, that, as they grow outward, their bottoms become filled up with smaller cells, but their structure nowhere presents the septate form so observable in *Chætetes*.

In two of the specimens of *Coscinium Cyclops* before me, the longitudinal striæ noticed by Keyserling are very distinct, covering almost the entire surface of one: they seem to consist of irregular, subangular, or round striate longitudinal ridges, in subparallel tortuous lines, which separate the alternating lines of larger cells on either side. These striæ, when more weathered, seem to be formed of long cells inclined outward, which, coming to the outer face of the plates, form the intercellular spaces. Near the base, where the structure is more condensed, these striæ are frequently covered in places by thin laminæ transversely wrinkled, showing the beginning of the cells which go to the free surface. It is possible, that the ridges of one plate may fit into the depressions between the ridges of the other, but this we could not verify by observation. These striations, which are regarded by Keyserling as sutures between the alternating rows of cells, are very beautiful in their arrangement; running in tortuous, subparallel, longitudinal lines, they form somewhat concentric waves around the large holes, which gives to the whole a peculiar and graceful appearance. This arrangement is given by alternate expansions and contractions from the branching and coalescence of the rays. In regard to the large holes or dimples, they are only apparently filled with foreign matter; on a close examination, we find large cells proceeding from the middle plate, filling the space between the sharply defined and thin borders of the holes, and placed at a right angle to the plane of the expansion. There seems to have been a rythmical development of the middle plate, which gave rise to these cells at an angle differing from that of the alternating lines of cells, which is oblique to the surface.

In the dimpled species, which we shall describe below, the cells seem to have been rythmically abortive, and their outlines are only marked upon the surface of the bottom of the depressions.

The oblique cells present, in one form, the characters assigned them by Keyserling, but this form seems to be the result of weathering. In perfectly preserved surfaces of two specimens of a new species, they are subcircular, with a distinctly raised lip.

In the new species above referred to, the *Keyserlingi*, we find that the long elliptical dimples are arranged in oblique lines on two sides of a middle row of elliptical dimples, running perpendicularly, or as the barbs of a feather upon its vane; this middle row of dimples is found at the bottom of an angular folding, or a very broad and deep inflection of the leaf.

In these features of their organization these forms seem to differ from the *Eschara*, where the bases of two opposite rows of cells are cemented base to base, so as to form the divisional or middle plate. The sinuous and contorted irregularity of the base of the corrallum, and their internal structure, would seem to us to place them in nearer alliance with the *Cellepora cervicornis*, which was at one time regarded as an *Eschara.*

Coscinium Cyclops (*Keyserling*).

We have three specimens of this species, belonging to the cabinet of our friend Dr. B. F. Shumard, one of which presents nearly the same distances between the openings or holes and the cells as the specimen from which Keyserling drew his description. The two others are somewhat imperfect, but one gives the beautiful striated structure referred to above. This, and the next species to be described from the same cabinet, are Devonian species, found at the Falls of the Ohio. This places the *Coscinium Cyclops* in this country much lower in its stratigraphical horizon than in Europe, where it has been found only in the Carboniferous series.

COSCINIUM CRIBRIFORMIS (*Prout*).

Leaf-like expansion broad, holes arranged quincuncially in alternating oblique lines, in the space of 20 mm. there are five in oblique lines, and nearly five transversely, oblong oval in form, long diameter 2.5 to 3 mm., short diameter 2 mm., about 1.3 mm. apart on oblique lines, about 1 mm. transversely; cells, five in oblique lines in the space of 2 mm., less than their own diameters apart, more or less orbicular, being much worn, with the appearance of a minutely cellular structure separating them on more perfect portions of the frond; these minute cells, when filled up, cause the surface to appear granular. The two tables or plates are very distinct in this species; they seem to thicken in the middle of the space between the thin borders of the large holes, which latter seem to be filled up by larger cells rythmically developed from the mesial plate, in a direction almost opposite to that of the obliquely arranged cells of the general surface.

Comparison.—It resembles in some measure the *C. stenops* of Keyserling, but differs from it by the larger and more expanded form of its leaf-like expansion, the relative size of its holes, the number of cells in a given space, but mostly in the relative distance between the holes longitudinally and transversely, the distance being short longitudinally and wide transversely in the *C. stenops*, which is the reverse in this species.

We were at first disposed to refer this species to the *C. stenops*, supposing it to be a broader or more expanded portion of the ramified stem-like specimen from which Keyserling drew his description; but the relative distance between the holes, which no accidents of growth except compression were likely to change, induced us to separate it from that species.

Formation and Locality.—Shell-bed, Devonian, Falls of the Ohio.

COSCINIUM KEYSERLINGI (*Prout*).

Foliaceous expansion thin and delicate, with elliptical or oblong oval dimples having raised borders, not seeming to result from age or compression, arranged in sub-regular oblique lines, on the two sides of a middle row of long dimples, similar to the barbs of a feather upon its vane; the row of dimples is found at the bottom of an angular depression, or inflection of the leaf. The space between the dimples on the oblique lines is 3 mm., and between the oblique rows from 2.5 to 3 mm. The diameter of the holes is from 3 to 3.5 mm. in length by 1 mm. in width; in a space of 20 mm. in the oblique lines six dimples are found on a surface slightly waved transversely. Cell pores five in oblique lines, five transversely; cells with prominent round lips; apertures round or suboval, larger and more distinct on the borders of the dimples; bottom of the dimples marked with cells which seem to have been rythmically abortive. In one specimen, where the cells are worn, the labial borders are destroyed, and the cells appear more or less orbicular, or suboval. This beautiful species we dedicate to M. Keyserling, the learned founder of the genus. We have before us three specimens belonging to the collection of Dr. B. F. Shumard. One of these presents several characters belonging to the species *Coscinium Cyclops* near its base, as described by Keyserling from a specimen brought by Dr. Ruprecht from the Mountain Limestone at the confluence of the Gusinetz with the Indiga River. It differs, however, in the dimples being longer and more distinct, in having six dimples side by side in 20 mm., and in the form and prominence of its cells. The dimples and cells correspond to those of the wider expansions of the species which we have described above.

Formation and Locality.—Archimedes Limestone, Warsaw, Illinois.

After a very careful comparison of *Coscinium* with the genus *Clathropora of Hall* we find no material difference between them; in the latter, the intercellular spaces are more compact, and become more sharply septate or divisional to the pores, but under a moderate power of the microscope are seen to be distinctly tubular porous. In a cross-fracture of the frond, the cell structure resembles more closely that of *Eschara* than is the case with *Coscinium*, but as in *Coscinium* its mesial plate is seen to be occasionally cellular. In the specimen of *Clathropora frondosa of Hall*, under examination, we can perceive traces of the perpendicular cells which fill the holes or depressions.

| L. 2x8 T. / [6] |* POLYPORA MEXICANA (*Prout*).

Corrallum a small funnel-shaped expansion, which to the naked eye appears regularly meshed. It is fractured so as to show the pores on the medallion surface.

Longitudinal rays sub-regular in size, dichotomizations not very numerous, at the distance of two and five lines apart arising from the intercalation of an additional line of fenestrules; a little or much expanded at junction with dissepiments.

Dissepiments from one-third to one-half of the size of the

* The symbol used here indicates the number of fenestrules or oscules found in the length or breadth of 2 lines. These multiplied give below the number in 2 lines square.

rays, thick, short and expanded at junction, occasionally poriferous.

Fenestrules large, long, oval, two in the space of two lines longitudinally, three transversely, in nearly regular lines vertically.

Cell pores small, numerous, in oblique lines across the ray, seldom varying in number on the same ray, from three to seven in the oblique lines according to the size of the interstices, which sometimes become smaller after bifurcation, about six or eight to the length of an oscule.

This neat specimen is about one inch long, but must have been longer; the substance of the corrallum is broken away so as to show the medallion face, but sufficient remains to manifest the characters given above. It was imbedded in a black limestone, and the contrast formed by its white rays and dissepiments is very marked.

This species bears a very striking resemblance to the *Polypora verrucosa* of McCoy (Brit. Palæ. Foss., p. 116), but differs in the smaller size and inequality of the longitudinal rays in having from three to five vertical rows of pores, or as often three as four. The cells in the specimen are not well preserved, except probably at one point, where they seem to have a swelled base, and are not wart-like. The cells in the oblique lines vary from four to seven, with only from six to eight to each oscule; there are only two oscules in the space of two lines. These differences we deem of sufficient weight to claim for it, at least provisionally, a new name.

Formation and Locality.—Permian Strata, Jornada del Muerto, New Mexico, Collection of the U. S. Government Expedition for Boring Artesian Wells, under the direction of Capt. John Pope, U. S. Corps Top. Eng.

L. 4x4 T. [16]	POLYPORA SHUMARDII (*Prout*).

Corrallum broadly fan-shaped, or perhaps funnel-shaped; bifurcations frequent, so as to cause the upper part of the expansion to fold in longitudinal plaits.

Longitudinal rays large, round, or flatly vaulted on both sides, occasionally alternately thickened and attenuated, being irregular in size compared with one another, dichotomizing at a distance of from seven to two lines apart upwards.

Dissepiments about one-third as large as the interstices, sometimes much expanded at their junction, occasionally elevated or depressed above or below a true transverse line, very occasionally poriferous.

Fenestrules on reverse depressed, round, or subcircular, as wide as many of the large longitudinal rays, as broad as long, sometimes broader; on medallion face somewhat smaller and oval, little or very slightly depressed.

Cell pores in lines oblique to the axis of the rays, very numerous and small, varying from three to seven in the oblique lines according to the relative sizes of the rays, and the amount of expansion at the bifurcations, about three or four to each oscule; no material alteration in the number of lines of pores on the same ray, except immediately below the bifurcations.

Reverse thick, white, smooth, condensed, microscopically celluliferous or striate.

We dedicate this large and beautiful species to our friend Dr. B. F. Shumard, whose contributions to Western Palæontology merit the highest praise, and to whose kindness and liberality we are indebted for all the specimens which we have described in this series. The expansion from which the description is drawn is a large part of a very large corrallum, measuring some four inches in length by three in width.

Formation and Locality.—Shell-beds, *Devonian*, Falls of the Ohio.

L. 7x9 T.
[63]

POLYPORA INTERMEDIA (*Prout*).

Corrallum small, fan-shaped, but probably funnel-shaped, irregularly waved longitudinally.

Longitudinal rays with a striated sole for the cell pores, irregular in size individually or collectively, being sometimes tumid and sometimes attenuated, becoming smaller above the bifurcations.

Dissepiments thick, short, and expanded at junction with longitudinal rays.

Fenestrules oval, subalternate, or in obliquely waved lines, seven in the space of two lines longitudinally, nine in the same space transversely.

Cell pores large, about two or three to each oscule, generally only two lines to each longitudinal ray, occasionally three at the bifurcations.

Reverse white, condensed, cortical surface microscopically porous or striate.

At first we felt some hesitation in founding a new species upon this specimen, thinking it might possibly be only a young frond of the *P. Varsoviensis*, but we are now satisfied that it is a different species.

It is often difficult to draw distinctions among the species of this genus. The cell development takes place obliquely upward and forward from a sole or basis of minutely longitudinal tubes, so arranged as to present the appearance of being striated. The reverse is covered with a whitish, thickened, cortical substance, which is generally almost smooth, or minutely striate or porous under a high magnifying power. All forms present such close general analogies, that we are compelled in a measure to rely upon their varied forms, the relative shape and size of their oscules, and the number of pores, as indicia for specific distinctions. The species above, if the medallion face alone were observed, would be classed probably as a *Fenestella*; but its flattened sole, and other characters, place it among *Polypora*. We regard it as a species showing the transition from the one genus to the other, the difference being mostly in the rounder, or more basaltiform, and regularly distributed longitudinal rays of the *Fenestella*.

Comparison.—It resembles in its characters *Polypora laxa* (McCoy), *Retepora laxa* (Phil. Geol. York., Vol. II., pl. 1, fig. 26-30), and *Fenestella laxa* (Phil. Palæoz. Fos., p. 28); but differs in being smaller, in the more regular distribution of its longitudinal rays, and the larger size of its cells.

Formation and Locality.—Shell-beds, Devonian, Falls of the Ohio.

OBSERVATIONS *on the* GEOLOGICAL FORMATIONS *of the Country between the Rio Pecos and the Rio Grande, in New Mexico, near the line of the 32d Parallel; being an Abstract of a portion of the Geological Report of the Expedition under Capt.* JOHN POPE, *Corps Top. Eng., U. S. A., in the year* 1855, *by* GEO. G. SHUMARD, M.D., *Geologist of the Expedition. Communicated to the Academy, with the permission of Capt. Pope, in advance of the publication of his official report.*

The Expedition remained, for several months, encamped on the Rio Pecos, near the mouth of Delaware Creek, and a favorable opportunity was thus afforded for examining minutely the geological structure of that vicinity. The Llano Estacado was to be seen from our camp, stretching for an indefinite distance eastward, in the form of an elevated and gently undulating plateau, thinly covered with short grass, and presenting, generally, but little variety of surface. It is abruptly terminated, on the west, by the Pecos River, which flows, in a tortuous course, with an average width of about eighty feet, amid low hills and bluffs of conglomerate and limestone. Beyond the Pecos, the country assumes a more broken and hilly appearance, and, at the distance of sixty miles, rise the lofty summits of the Guadalupe Mountains, of which the highest points had been observed long before we arrived at the mouth of Delaware Creek.

The following is a section taken near the mouth of Delaware creek:

1. Quaternary Conglomerate, composed of limestone from the Guadalupe Mountains	70 feet.
2. Upper Cretaceous limestone	100* "
3. Lower Cretaceous marls and sandstone (as far as bored)	860 "
Total thickness	1030 feet.

The rocks of this vicinity, save the limestone noticed on our last day's journey, were found to differ somewhat, in general character, from those observed further to the eastward on our line of march. The limestone, here, attains a thickness of over a hundred feet, exhibiting itself chiefly in the form of flattened conical hills and rough cliffs, sometimes with vertical faces and in places rising above the creek or river bed to the height of fifty or sixty feet. The rock is usually hard, of a light cream color and earthy texture, and contains numerous spheroidal cavities from a fourth to a half an inch in diameter, which are sometimes partially filled with loose, ferruginous earth. In one locality, the exposed edges of the strata were covered with an incrustation of salt a fourth of an inch thick. This limestone forms the bed of the Pecos River, and here gives rise to a succession of rapids. Fourteen miles to the eastward, the same limestone becomes much softer and lighter colored, and resembles impure chalk, but does not there exceed in thickness thirteen or fourteen feet. Fossils are exceedingly rare in it. In a few instances, I obtained imperfect specimens of *Gryphæa Pitcheri* and *Janira quadricostata.* Underneath the limestone, we have deposits of gypsum, clay, and sandstone, which are often well exposed in this vicinity. The gypsum is frequently found in connexion with white, soft carbonate of lime, and presents an average thickness of about twenty-five feet. From the Artesian Wells, situated, one fourteen, and the other eight miles east of the Rio Pecos, vertical sections of the clay and sandstone were obtained to the depth of eight hundred and fifty-eight feet. The clay is, usually, highly indurated, and contains more or less of an admixture of lime. In color, it varies from nearly white to blue, brown, and vermilion. The intercalated layers of sandstone are generally softer than those previously encountered, and constitute by far the greater portion of the exposed thickness of the formation. The superior beds are often little else than loosely coherent sand, but, at the base of the sections, the strata are much firmer and of a light yellow colour, and contain small rounded pebbles of eruptive rocks.

Besides the strata above described, the superincumbent quaternary conglomerate is, also, largely developed. Near the junction of the Pecos and Delaware Creek, this formation

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* The Upper Cretaceous limestone, at some points about one hundred miles eastward, attains a thickness of 1100 feet.

attains a thickness of nearly seventy feet, and appears, mostly, in the form of gently rounded hills and ridges, some of which terminate abruptly toward the river. With the exception of being somewhat coarser and occasionally traversed by irregular bands of coarse, yellow, silicious sandstone, the materials composing it do not differ from those of the same formation last described. Many of the included masses are rich in organic remains, and present a considerable variety of species of Upper Palæozoic types. The most common are: *Productus semireticulatus*, *P. splendens*(?), *Chonetes Smithi*(?), *Camaraphoria Schlotheimii*, and a remarkably elongated species of *Fusulina.** Commingled with these I found a few imperfect Cretaceous species in angular fragments of soft, yellow limestone, as follows: *Arcopagia Texana*, *Janira quadricostata*, *Cardium multistriatum*, and *Gryphæa Pitcheri*. From the general appearance of these fossils they evidently could not have been transported far.

Directly south of Delaware Creek, the strata are strongly folded and inclined in different directions, at angles varying from twenty to fifty degrees. The period of disturbance appears to have been anterior to the deposition of the conglomerate, since the latter is found reposing uncomformably, in nearly horizontal beds, on the ruptured edges of the older strata.

A section was taken from a nearly vertical exposure extending along the west bank of the Rio Pecos from near the mouth of Delaware Creek S.S.E., for the distance of about half a mile. Here, the limestone is found dipping in opposite directions, at angles varying from 20° to 30°, the upper beds having been ruptured and widely separated, and the entire mass traversed from top to bottom by fissures ten or twenty feet wide, filled, chiefly, with small angular fragments of limestone firmly cemented with calcareous matter. In one place, near the base of the section, beds of gypsum are exposed to the thickness of fifteen feet. It is for the most part a white amorphous variety, and resembles, more or less, loaf sugar.

Another section was taken from near the east bank of the Rio Pecos, several miles below the last. It exhibits a still greater amount of disturbance, the underlying clay and sandstone being here well exposed, dipping in opposite directions, at angles of from 45° to 50°, and, at the same time, the upturned edges of the limestone appear somewhat altered in texture, being harder and sometimes fractured into small angular fragments firmly re-cemented so as to give the rock a fragmentary or brecciated appearance. The sandstone is also harder, of dark red and purple colors, and thickly besprinkled with small green and yellow spots.

* *Fusulina elongata* (*Shumard*).

The extent of this region of disturbance could not be accurately determined on account of the levelling effects of the subsequent denudation and the thickness of the superincumbent deposits of more recent date; but from the fact, that the limestone is observed for a distance of twelve or fifteen miles, both east and west of the Pecos River, in nearly horizontal strata, and appears merely in gentle undulations, at a point only a few miles south of the place where the last mentioned section was seen, it is highly probable that it does not, in any direction, exceed fifteen or twenty miles.

Proceeding from the mouth of Delaware Creek, on a westward course, our road, for the first few miles, wound amid gently rounded hills and ridges of quaternary conglomerate or limestone breccia, from thirty to a hundred feet high, with occasional exposures of Cretaceous limestone ten or fifteen feet in thickness. The soil and subsoil were calcareo-silicious. As we proceed, the conglomerate gradually thins out, and, finally, appears only at intervals, while the limestone is much more largely developed, and forms short ridges and truncated conical hills sometimes five or six hundred feet in height. Occasionally, these were isolated and widely separated from each other, and sometimes grouped together in clusters of eight or ten. In general outline and composition, they very closely resemble the hills and ridges previously encountered farther east, thus indicating, pretty clearly, that they constitute the remains of a once continuous table land, of the former existence of which, and its subsequent removal by denudation, they are the monuments. The dip of the strata is, pretty uniformly, about 1° E.S.E. Near the summit of some of the highest elevations, hard, projecting bands of brown and light gray limestone occur, but, unlike those forming the summits of the hills and cliffs farther east, they are exceedingly barren of fossils, and have yielded, after a careful search, but a single imperfect specimen of *Mytilus*. In conformable beds beneath the limestone, we find red marly clay, sandstone, and gypsum, exhibited in nearly vertical sections sixty or seventy feet in height. The gypsum is, in places, deeply discolored with oxide of iron; and the surface of the country is covered with powdered gypsum and white carbonate of lime, sometimes ten feet in thickness. The soil, along the valley of Delaware Creek, is moderately fertile, and composed of sand, clay, and lime, in variable proportions. The water of the stream is clear, but has a strong, disagreeable taste.

For several miles from this point, our road lay over thick beds of marly clay, gypsum, and limestone. The clay varies in color from bright vermilion to deep blue. The gypsum presents, in places, a thickness of about sixty feet, and assumes every degree of compactness from the soft pulverulent variety, before noticed, to compact bluish-white alabaster. The softer varieties often pass upwards, almost insensibly, into beds of soft, white carbonate of lime, sometimes fifteen or twenty feet thick.

As we continue to advance, the compact limestone rapidly diminishes in thickness, and, in a distance of six miles, disappears entirely, and is replaced by thick beds of quaternary breccia, much coarser than any previously encountered, and abounding in a great variety of fossils. We are evidently approaching the source of this deposit, since the fragments are not only larger and more angular, but the formation is increasing rapidly in thickness, which, in some places, was estimated at from four to five hundred feet.

At the distance of about thirty miles from the mouth of Delaware Creek, the red and blue clay, gypsum, and pulverulent carbonate of lime, which had been largely exhibited, for several miles, along our route, suddenly disappeared, and strata with fossils of the Upper Coal Measures came into view, in low hills and ridges. They consist of yellow, quartzose sandstone, surmounted by black, gray, and white limestone, as exhibited in the following section (descending):

1. Heavy bedded, compact, white and light-gray limestone.
2. Black, thinly laminated limestone .... 100 feet.
3. Dark-gray, thin-bedded, crystalline limestone .... 50 "
4. Yellow quartzose sandstone, with thin seams of black, compact limestone interstratified at its upper portion.*

These rocks are unconformable with the Cretaceous, though the dip is still E.S.E. Owing to the great thickness of the quaternary deposits, the upper white limestone is not well-exposed, just at this point; but at other places, not far distant, it presents a thickness of several hundred feet. It is, usually, a hard, crystalline limestone, abounding in fossils identical with those so frequently observed in the breccia.

The organic remains of this limestone, so far as they have been described, are as follows: *Productus semireticulatus*, *P. splendens*(?), *Chonetes Smithi*(?), and *Spirifer plano-convexa.* These species, in the Western and Southwestern States, are chiefly found in the upper division of the Carboniferous system, or Coal Measures.

From the dark-gray limestone (No. 3 of the section), the following undescribed fossils were obtained, which, as far as my observations extend, are peculiar to this portion of the formation: they are *Rhynconella*, *Camaraphoria*, *Straparollus* (two species), and *Phillipsia.*

* A comparison of the fossils of the beds of this section with species described and figured from the Permian System of England and Russia, and also with those recently discovered by Maj. Hawn in Kansas, described by Prof. Swallow and Messrs. Meek and Hayden, proves them to be of Permian Age. (See announcement of Permian Rocks in New Mexico, Trans. Acad. Sci. St. Louis, Meet. March 8, 1858.)

No fossils were observed in the underlying sandstone. This rock is fine-grained, more or less micaceous, and of moderate hardness. Although sometimes exposed in heavy, massive strata, it is, for the most part, thin-bedded, and, occasionally, finely laminated. It contains, near its upper portion, bands of dark, compact limestone from a few inches to two feet thick.

Denudation.—As we proceeded on our way, the country everywhere exhibited the strongest evidence of denudation, being deeply excavated, and often appearing in detached hills, usually of a conical form, and sometimes separated from each other by intervals of several hundred yards. The limestone is, now, only occasionally observed capping the summits of the highest elevations, and nowhere presents a thickness of more than one or two hundred feet. Immediately south of our route, the country is much cut up by deep valleys and rocky ravines; to the north, the surface, although less broken, is, nevertheless, rough, and thickly strewn with coarse, angular fragments of limestone. By following the windings of the different valleys, our road was, for the most part, a smooth and gentle ascent, the rate corresponding pretty nearly with the dip of the strata. The quaternary breccia still prevailed, with an average thickness of over two hundred feet, containing angular blocks of limestone sometimes several feet in diameter.

Head of Delaware Creek.—This stream rises in a broad and fertile valley, and is formed by the united waters of several springs that issue from the base of the breccia or conglomerate and the upper portion of the sandstone which constitutes the floor of the valley. These springs are contiguous to each other, but vary, remarkably, in character. When they issue from the conglomerate, the water is clear and slightly calcareous, and has an agreeable taste; but when they flow from the sandstone, they are highly impregnated with various saline ingredients, have a disagreeable taste, and emit a strong odor of sulphuretted hydrogen. At this point, the valley of the creek is about two hundred and fifty feet deep, and its width is from a few hundred yards to several miles. It appears to have been hollowed out of the solid strata by denudation. On either side are abrupt escarpments and hills of massive and thin-bedded sandstone, surmounted by heavy and finely laminated strata of limestone, as exhibited in the following section:

1. Heavy bedded, gray and white limestone	50 feet.
2. Finely laminated, black limestone	110 "
3. Heavy and thin-bedded, yellow, quartzose sandstone, with thin seams of black, compact limestone interstratified	100 "
Total thickness	260 feet.

These beds appear to be precisely the same as those observed on Delaware Creek, thirty miles above its confluence. The floor of the valley is generally smooth, but here and there marked with ridges and abrupt conical hills of sandstone and limestone, from one to two hundred feet high. The soil is calcareous, calcareo-argillaceous, and, in some places, silicious.

At a short distance from this point, we begin to approach, by a gentle ascent, the eastern base of the Guadalupe Mountains. The hills are, for the most part, gracefully rounded, and from one to four hundred feet high: the valleys to the south, become much deeper. The strata do not differ much from those already described. In places, the sandstone is exposed, by denudation, to the height of six hundred feet. The overlying limestones are confined mostly to the hills, and, at some points, exhibit a thickness of nearly four hundred feet. They are filled with fossils of the same character as those last enumerated. The dip is still E.S.E., but with a gradually increasing angle. No evidence appears of any sudden or violent disturbance, but the uplifting of the strata has evidently been the result of causes operating in a uniform and very gradual manner. The subsequent denudation, to which they have been so largely subjected, has imparted to this region a rough and broken aspect. By following the valleys, which have a general east and west bearing, the ascent is easy.

From Independence Springs, which bubble up through nearly circular openings in the sand-rock that composes the floor of the valley, to the eastern base of the Guadalupe Mountains, a distance of about six miles, there is a gradual ascent of several hundred feet. For the whole of the distance, the dark, thin-bedded limestone is well exposed. As we approach the mountains, the inclination of the strata increases, the dip being about 20° and the direction still E.S.E. At the mountains, they are seen to pass under the massive white limestone, which, as we shall soon see, is, here, much better developed than farther east. To the south, and apparently continuous with the line of upheaval of the mountains, the ruptured edges of the same strata are to be seen presenting, to the west, rugged and nearly vertical escarpments, from fifteen hundred to two thousand feet high and extending southward as far as vision reaches. These cliffs are occasionally capped with light-colored limestone, but, generally, this rock has been removed by denudation.

The Guadalupe Mountains, near their southern extremity, rise abruptly from a gently ascending surface, and attain, at the highest point, an altitude of nearly 3,000 feet above their base, and about 8,000 feet above the level of the ocean. The main axis or line of upheaval, trends somewhat irregularly north-east and southwest. From one point of observation, there is a gradual descent to the northeast, while, to the south, the range terminates abruptly in a frightful precipice upwards of 2,000 feet in height. Around the base of this precipice our road led, by a gradual descent, through a deep cañon, with rough and nearly vertical cliffs on either side. The eastern slope is rapid towards the plains, and marked by deep and rugged cañons, often with nearly vertical sides. One of these cañons, situated near the southern extremity, and known as "*The Pinery*," was explored for the distance of about a mile. At some points, it is upwards of half a mile wide, and bounded, on either side, by vertical, or abruptly sloping walls of such extreme height, that their summits often appear enveloped in clouds. It is only when observed from the west, however, that these mountains can be contemplated in all their grandeur. Here extends an unbroken line of vertical precipices, from two to three thousand feet in height, the faces of which are so smooth as to be accessible only a few hundred feet above the base. The abrupt faces of these cliffs pursue a general course parallel with the axis of upheaval of the mountains, which present the appearance of having been cleft vertically through their centre, and the western halves removed. They attain their greatest elevation about one mile north of the southern extremity, from which point there is a gradual descent to the north and south.

Geological Structure.—The Guadalupe Mountains consist of white, gray, and bluish-black limestone, and fine and coarse-grained quartzose sandstone. They present the following section in descending order:

1. Upper or white limestone	1000 feet.
2. Dark-colored, thinly laminated and foliated limestone	50 to 100 "
3. Yellow quartzose sandstone	1200 " 1500 "
4. Black, thin-bedded limestone	500 "

The white and gray limestone reposes, in heavy beds, upon the sandstone, and exhibits the enormous thickness of more than a thousand feet. It is harder than any previously encountered, but, in all other respects, it is precisely of the same character as that seen at the head of Delaware Creek, and between that point and the Guadalupe Mountains. It is remarkably rich in organic remains, a large portion of which are new to science; but others appear to be forms of the Coal Measures. Some of the layers of white limestone* are composed, almost wholly, of remains of Crinoidea. I collected a number of species of fossils from these beds, viz.: *Productus semireticulatus*, *P. splendens*(?), *Productus* (several undetermined species), *Chonetes Smithi*, *Rhynconella* (several

* For description of New Fossils from the White Limestone, see the paper of Dr. B. F. Shumard, *post*.

undetermined species), *Spirifer plano-convexa*, and *Avicula*, *Cypricardia*, *Straparollus*, *Cyathophyllum*, *Fenestella*, *Chætetes*, and *Phillipsia*, of each, one or more undescribed species. With these occurs a slender *Fusulina*, upwards of an inch in length, which appears to be quite distinct from the *Fusulina cylindrica*, so characteristic of the Coal Measures of the Missouri River. There is also a brachiopod, which possesses all the external characters of *Camaraphoria Schlotheimii* (Verneuil sp.), of the Permian system of Russia.*

From the dark limestone interposed between the white limestone and sandstone (No. 2 of Sec.) fossils were collected which are identical with those occurring in the beds near the head of Delaware Creek.

The sandstone is best displayed in the cañon, and on the western side of the mountains. In the latter position, it exhibits a thickness (estimated approximately) of from twelve to fifteen hundred feet. Toward the top it is soft, and abounds in fossils, as follows: *Spirifer cameratus*, *Spirigera subtilita*, *Productus* (new sp.*), *Spirifer plano-convexa*, *Bellerophon*, and *Fusulina elongata*. At one point, strata upwards of a hundred feet in thickness are composed, almost entirely, of the last mentioned fossil.

The inferior layers are generally compact, coarse-grained, and micaceous. At the base, are intercalated bands of hard, dark, argillaceous shale, and, beneath these, are thin layers of dark, compact limestone, which, at a locality a little north of the Pass, is exposed to the thickness of five hundred feet. Diligent search was made for fossils in these beds, but no traces of any were detected.

As we wind around the southern extremity of the mountains, the descent is gradual over the upturned edges of the limestone strata; and, afterwards, the fine and coarse-grained sandstone, shale, and underlying dark-colored limestone, were successively passed over.

Beyond the foot of the cañon, a range of hills, from five to eight hundred feet in height, presents a precipitous face towards the east, extending, irregularly, for several miles, in a direction nearly parallel with the mountains. In this range, the dip of the strata is 25° W.N.W., or in a direction contrary to that observed in the Guadalupe Mountains. But the rocks

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* Since the above was read before the Academy, a closer examination of the fossils of the white limestone, dark limestone, and yellow sandstone (Nos. 1, 2 & 3 of this section), has been made by Dr. B. F. Shumard, which has resulted in the discovery of other Permian species ranging through all these strata, and which establishes, we think satisfactorily, their Permian age. The age of the black limestone (No. 4) is still doubtful, although our opinion is that it is likewise Permian. (See Proc. of the Academy in this No., meeting of March 8, 1858.)

† *Productus Popei*, following paper on Permian Fossils.

are in all respects similar to those of the mountains, a portion of the western slope of which they, at one time, formed, although, at present, separated by a deep valley several miles wide. Facing, also, in an easterly direction, and about fifteen miles to the southwest, there occurs an extensive range of rugged cliffs, from the summits of which the surface slopes gently towards the west. These cliffs, as well as could be determined from a distance, are from a thousand to fifteen hundred feet in height. Their bearing is nearly parallel with the escarpments south of the mountains, which they very closely resemble in general appearance, and, doubtless, they have the same geological composition. Between the ranges is a broad and gently undulating valley, with its surface often dotted with small saline lakes.

Passing through this valley, we emerged into a broad and gently undulating country, the surface of which consists chiefly of tenaceous, red, calcareo-argillaceous clay, coarse yellow quartz-sand, and limestone detritus, which is often firmly consolidated by means of calcareous matter, and characterized by fossils different from those found in the mountains. Its general thickness is about ten feet. Three or four miles to the southward of our road were seen several shallow saline lakes, some of them two to three miles in circumference. Their flat beds, after evaporation, are often encrusted with salt to the thickness of several inches. Some miles further on, we came upon a range of hills of fine yellowish silicious sand, extending five or six miles to the southward, with an average width of about a mile. These hills appeared to be shifting their position, in a northwardly direction, burying the mezquite bushes as they advanced. At the distance of twenty-four miles from the foot of the Pass, there occur several small shallow lakes, the water of which is strongly impregnated with gypsum, and the dry beds of some, a little further off, are thickly covered with small shining particles of selenite. Beyond these, we travelled over a slightly undulating prairie underlaid by beds of red marly clay and white earthy carbonate of lime, the latter not unfrequently mixed with soft white gypsum, and presenting a general thickness of fifteen or twenty feet. We then came to an extensive outcrop of dark-gray, subcrystalline, and highly fossiliferous limestone. This rock contains, in a few places, bands of soft ferruginous sandstone, and is marked by fossils of the Coal Measures, as follows: *Bellerophon Montfortianus*(?) (Norw. & Prat.), *Orthisina umbraculum*, *Straparollus catilloides*(?), and remains of *Crinoidea*. Among the loose detritus, I observed some small fragments of soft, yellow, earthy, cretaceous limestone containing *Ostrea*.

Massive strata of dark-gray, subcrystalline limestone of the Coal Measures were largely exhibited, for several miles further on. The rock, in some places, presents a thickness of nearly four hundred feet, and differs from the limestone last mentioned, only, in being harder, and, occasionally, more or less cherty. The embedded fossils are, usually, finely preserved, and often so thickly crowded as to constitute the larger part of beds many feet in thickness. The most common species are *Spirigera subtilita*, *Productus semireticulatus*, *P. muricatus*, and *Straparollus*, *Pleurotomaria*, *Bellerophon*, and *Archæocidaris*, of undescribed species.

As we progress, the strata become highly contorted, the surface more undulating, and the hills, which attain a height of from fifty to one hundred feet, characterized by gentle slopes, until we arrive at the Cornudas Mountain, an isolated mass of eruptive rock, rising almost vertically to the height of six or seven hundred feet, and appearing at a little distance to be composed of materials thrown confusedly together. On every side, it presents rugged and nearly vertical cliffs, some of them fissured, and exhibiting near their bases small triangular openings. The largest of these extends into the mountain nearly a hundred feet, and terminates in a spacious chamber of an irregular elliptical form, with a pool of pure water in the centre.

The Cornudas Mountain extends about one mile northeast and southwest, and its width is from a half to three-fourths of a mile. It is composed entirely of compact, light-gray, albite granite, in which the albite predominates over the other ingredients. The mica is of a jet black color, and exists in very small particles. This granite disintegrates very rapidly.

From the Cornudas, the limestone presents a quaquaversal dip, at angles varying from 45° to 50°. Near the point of contact with the eruptive rocks, it is highly metamorphosed and converted into hard cellular rock of a dusky-brown color. Its visible thickness is upwards of five hundred feet, and, at a little distance from the erupted mass, the beds are crowded with fossils, many of them highly characteristic species of the Coal Measures.

After leaving the Cornudas, we continued to travel over highly undulated strata of limestone of the age of the Coal Measures. The surface of the country is rolling and diversified with low, rocky hills and ridges. Southwest of our road was an uninterrupted chain of hills of eruptive rocks, which, after connecting with the Sierra de los Alamos, stretch across the country for a number of miles in a southwest course. Eight miles from the Sierra Cornudas, we came to the Sierra de los Alamos, three rough, isolated peaks, the highest of which is about eight hundred feet above the general level of the country adjacent. These differ from the Cornudas somewhat in appearance and mineralogical composition, though undoubtedly forming a part of the same system of eruption.

The rock consists of granite, gneiss, and light-greenish porphyry. The granite is hard, compact, and fine-textured, and graduates almost imperceptibly into the gneiss and porphyry. The latter is usually hard, and contains crystals sometimes of quartz, and sometimes felspar. On both sides of the eruptive rocks, the Upper Carboniferous limestone is slightly metamorphosed and inclined at angles of 10° to 30°. Beyond the Sierra de los Alamos, this limestone is largely developed, and, in places, crowded with characteristic Carboniferous fossils. It extends to the Sierra Alto, in undulating strata, and the surface of the country is marked with low hills and ridges, from the rocky sides of which fossils were obtained in the greatest abundance.

The *Sierra Alto* rises majestically from a nearly quadrangular base to the height of about fifteen hundred feet. It is completely isolated from the neighbouring mountains, and its rugged summit projects considerably above the highest of them. Its main axis extends nearly east and west, for the distance of about two miles, and its width varies from a fourth to about three-fourths of a mile. On all sides, it is surrounded by hills and ridges, which present abrupt faces toward the mountain, and slope gradually in the opposite direction. The mountain is composed of hard granite of a light gray color, in which the felspar predominates over the quartz and mica. The weathered face of the rock presents sometimes a yellow and sometimes a brown color, and, occasionally, exhibits a jointed structure, but more frequently a smooth and polished appearance. The surrounding hills and ridges consist of limestone and soft sandstone, which are strongly upheaved, and dip, quaquaversally, at angles of from 5° to 40°. The layers in contact with the eruptive mass are highly metamorphosed and of dirty brown and yellow colors. As well as could be determined from their exposed edges, the thickness of the limestone and sandstone cannot, here, fall short of 2500 feet. As we recede from the mountain, the dip of the strata becomes much less apparent, so that, in the distance of a mile, it does not anywhere exceed 5° to 10°.

The Pass.—Just before reaching the eastern base of the Sierra Alto, our road diverged from the emigrant trail, and, soon after, we entered an extensive gorge, which curves around the southern side of the mountain. This gorge or cañon is walled up throughout its entire extent with massive and, in places, nearly perpendicular escarpments of hard, bluish and gray subcrystalline limestone, and soft, yellow, and fine-grained sandstone, with occasional intercalations of dark-blue argillaceous shale. Near the eastern extremity, its average width is over a quarter of a mile, and, here, the strata are to be seen dipping southeast from 15° to 25°. As we advance, the cañon becomes much narrower, and the direction of the dip gradually changes, first, toward the south, and then to the southwest, gradually diminishing as we reach the western extremity of the Pass, where it does not exceed 5° or 10°. (See Sec. 1.)

As the strata exposed at the Pass are some distance removed from the central axis of eruption, they have undergone but slight metamorphic change, and are often densely crowded with fossils. Among these we recognize several species which are quite characteristic of the Coal Measures of Missouri, Illinois, and Kentucky, along with others that range downwards to the base of the Carboniferous system; but most of the species are yet undescribed. The list includes *Productus costatus*, *P. cora*, *Tellinomya protensa*(?), *Allorisma regularis*, *Bellerophon Urii*(?), *Bellerophon* (several new species), *Straparollus* (several new species), *Pleurotomaria*, *Murchisonia*, *Natica*, and *Chemnitzia* (several species). Most of the fossils, at this locality, were obtained from the debris at the base of the cliffs.

Sierra Hueco.—From the western extremity of the Sierra Alto, our road led, by a gradual descent, through a broken and hilly region, into a broad fertile valley, somewhat semicircular in its form. This valley, to the west and northwest, opens into the "Valley of the Salt Lakes," but, in every other direction, it is abruptly terminated by rough hills and cliffs of limestone from five to eight hundred feet high. Its floor consists entirely of eruptive rocks, of which the sharp and jagged points are seen protruding on either side, and, near the centre, rises the Hueco Mountain, precipitously, to the height of about six hundred feet. It is divided by a broad cañon into two nearly equal portions, and, on all sides, are vertical cliffs, often deeply fissured from top to bottom, affording, by their frowning appearance, a remarkable contrast with the smooth grassy surface by which they are surrounded.

The rock composing the Sierra Hueco is a fine-textured, light greenish-gray granite, which is soft, and crumbles readily on exposure to the weather. It contains a much larger proportion of felspar and less quartz than any of the granites we have hitherto encountered. The weathered edges present ferruginous brown and yellow colors.

The limestone of the Coal Measures, which constitutes the sides of the valley, has undergone little or no metamorphic change, and is rich in organic remains. Near the base occur strata, more than a hundred feet thick, composed almost entirely of a species of *Fusulina* quite different from *F. cylindrica* and from that characterizing the White Guadalupe Limestone. (See Sec. No. 2.)

The following section (No. 2) represents a distance of about four miles, the Hueco Mountain being in the centre, and on either side the valley bounded by cliffs of Limestone.

The rock consists of granite, gneiss, and light-greenish porphyry. The granite is hard, compact, and fine-textured, and graduates almost imperceptibly into the gneiss and porphyry. The latter is usually hard, and contains crystals sometimes of quartz, and sometimes felspar. On both sides of the eruptive rocks, the Upper Carboniferous limestone is slightly metamorphosed and inclined at angles of 10° to 30°. Beyond the Sierra de los Alamos, this limestone is largely developed, and, in places, crowded with characteristic Carboniferous fossils. It extends to the Sierra Alto, in undulating strata, and the surface of the country is marked with low hills and ridges, from the rocky sides of which fossils were obtained in the greatest abundance.

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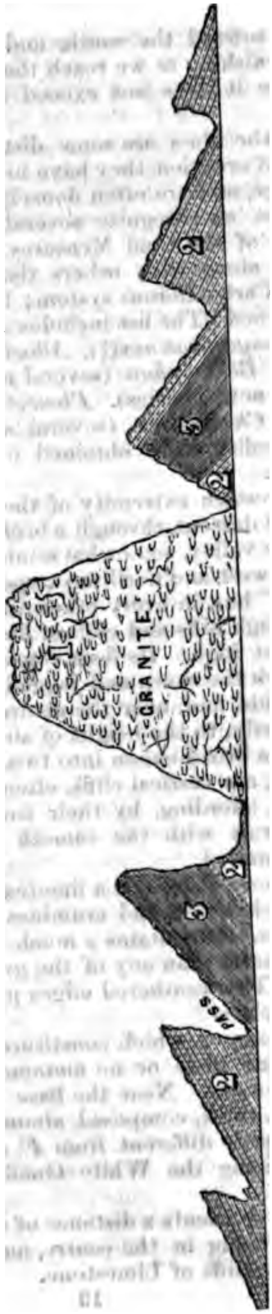
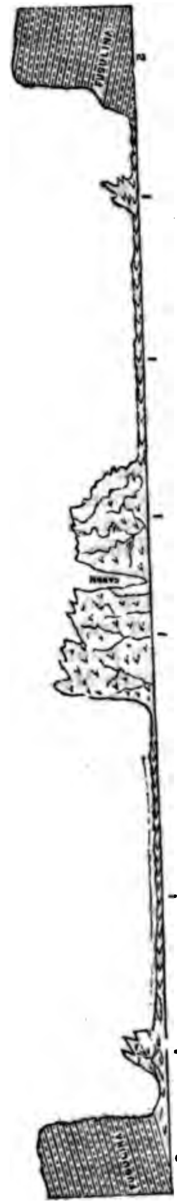
Section No. 1, Sierra Alto.



1. Granite. 2. Limestone. 3. Quartzose Sandstone.

Section No. 2.



1. Granite. 2. Limestone of the Coal Measures.

Valley of the Salt Lakes.—Shortly after leaving the Hueco Mountain, we entered the "Valley of the Salt Lakes," which stretches north and south several hundred miles. It is bounded on the west by the Organ and El Paso Mountains, the sharp and jagged outlines of which bespeak, even at this distance, the eruptive character of the rocks composing them. On the east, the valley is limited by an uninterrupted line of bold, abrupt cliffs of limestone, which, to the south, are continuous with the bluffs in the vicinity of the Hueco Mountain, while, in the opposite direction, they extend for a distance of forty or fifty miles, and terminate in the Sacramento Mountains, which rise majestically to an altitude of several thousand feet. A little west of this line of cliffs, and running parallel with them, is a chain of sharp ridges and conical hills, which connect with the Sierra Hueco, and possess, as far as examined, the same structure, being composed of fine-textured gray granite. At the point of entrance, the valley is about twenty-five miles wide, and has a smooth, even surface, covered, for the most part, with short grass; but, after entering it, we pass over coarse, reddish sand and detritus of eruptive rocks.

El Paso Mountains.—After travelling, for twenty-eight miles, over these deposits of sand and detritus, we reached the southern extremity of the El Paso Mountains, around which our road led, by a gradual descent into the valley of the Rio Grande. These mountains form a continuous chain about thirty miles in length, extending, as already intimated, in a north and south direction, and, although bearing a different name, they constitute merely a detached portion of the Organ range, from which they are separated, on the north, by a smooth valley, from a fourth to a half a mile wide. To the south, they terminate abruptly to form "The Pass," beyond which the lofty summits of the same range are again seen stretching southward for many miles. Viewed from the east, they rise abruptly from a smooth and gently ascending plain, attaining, at the highest points, an elevation of about 2500 feet. Their summits are generally sharp and jagged, and, to the north, they rise in succession one above the other like the pipes of an organ; and hence the name which has been applied to the entire range. As it will be shown hereafter, they vary considerably in composition. The southern portion consists of hard granite and porphyry. The granite greatly predominates over the porphyry, and varies in color from light-gray to deep vermilion. It is sometimes more or less porphyritic, and its hardness and durability would make it an excellent building material. The porphyry is confined chiefly to the summits. Usually, it is of a deep red color, and contains crystals of quartz and sometimes felspar. Near the western base, fragments of dark colored scoria were frequently observed.

Against the western declivity, the limestone strata are strongly upheaved, and where it is in immediate contact with the eruptive rocks, it is highly metamorphosed. I was much interested by finding, here, near the base of the exposure, well-marked strata of the inferior Silurian system, corresponding, in age, to the Blue Limestone of Cincinnati and the Hudson River group of the New-York series. The following fossils were procured from these beds: *Orthis testudinaria* (Dalman), *O. occidentalis* (Hall), *Rhynconella capax* (Conrad), *Rhynconella* (a species of the Blue Limestone of Cincinnati), *Streptelasma cornicula?* (Hall), and columns of Crinoids.

In following the windings of the Pass, we first descended over thick deposits of loose and partially consolidated detritus, after which nothing was encountered but granite and limestone. The surface is generally hilly, and slopes towards the Rio Grande, which is, here, of moderate depth, and flows over a rocky bed.

From this point to Doña Ana, the course of the Expedition was nearly north, pursuing the valley of the Rio Grande, which varies greatly in width, and is characterized by dark, rich, alluvial soil, bearing a luxuriant vegetation. From the east, the surface slopes towards the Rio Grande, and the western border is marked, for the first few miles above El Paso, by rugged mountains of granite and porphyry, and afterwards, by precipitous bluffs, which form the eastern edge of an elevated *mesa.* The soil is frequently encrusted with efflorescences of common salt and soda. The river has an average width of about one hundred yards. The water is moderately deep, and highly charged with fine yellow sediment. The El Paso Mountains exhibit the same general appearance and mineralogical composition as before. The limestone of the Lower Silurian system is seen strongly upheaved against the western base, until we reach a point ten or eleven miles north of the place where it was first discovered, when it disappears, and is succeeded by strata of the Carboniferous system, which are exposed, in places, to the thickness of about three hundred feet. Black ferruginous sand was observed in several localities near the base of the mountains, and the indications were such as to lead to the belief that this region may be found rich in valuable metals.

Palæontology.—Many of the organic remains of the upper division of the Cretaceous system have been described by Dr. Ferd. Rœmer, in his excellent and finely illustrated work on the Cretaceous strata of Texas. We are able, however, considerably to augment the list by the addition of a number of new and interesting forms, which have been placed in the hands of a Palæontologist for examination and description. We will, therefore, at present, merely enumerate some of the species which have been found most characteristic of the mass.

The following species have been found to range from the top to the base of the formation, viz: *Gryphæa Pitcheri* (Morton), *Exogyra arietina* (Rœm.), *Janira Texana* (Rœm. sp.) *Janira quadricostata* (Sowerby), and *Terebratula Wacoensis* (Rœmer).

In the upper part of the formation, we find most commonly the following, and, as far as our observations extend, they are peculiar to it: *Ceratites* (*Ammonites*) *pedernalis* (Rœm. sp.), *Pterodonta subfusiformis* (Shum.), *Pleurotomaria crotaloides* (Morton), *Scalaria vertebroides?* (Morton sp.), *Natica* (*Globiconcha*) *tumida* (Shum.), *Natica elevata* (Shum.), *Monopleura Texana* (Rœm.), *Lima Wacoensis* (Rœm.), *Ostrea crenulimargo* (Rœm.), *O. carinata* (Lamarck), *Panopæa Texana* (Shum.), and *Astrocœnia Guadalupae* (Rœm.)

In the inferior strata, the most characteristic forms are *Ammonites vespertinus* (Mort.), *A. Popeanus* (Shum.), *Turrilites Brazoensis* (Rœm.), *Baculites asper* (Mort.), *Exogyra costata* (Say), *E. arietina* (Rœm.), *E. læviuscula* (Rœm.), *Ostrea vesicularis* (Lam.), *Gryphæa Pitcheri* (Mort.), *Pecten* (sp. undet.), *Janira quadricostata?* (Sow.), *Inoceramus Cripsii* (Mant.), *I. mytiloides* (Mant.), *Inoceramus* (species undet.), *Pholadomya elegantula* (D'Orb.), *Cardium elegantulum* (Rœm.), *Cassidulus æquoreus* (Rœm.), *Terebratula Choctawensis* (Shum.), *Nerinea Texana* (Rœm.), and *Trigonia* (nov. sp.)

It will be seen from the above list of species, that, with some few exceptions, the fossils of the superior and inferior portions of the Upper Cretaceous strata of Texas and New Mexico are quite distinct. Nevertheless, as we cannot draw a well-marked horizon by lithological characters, we have thought proper to make no separation of the strata.

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Against the western declivity, the limestone strata are strongly upheaved, and where it is in immediate contact with the eruptive rocks, it is highly metamorphosed. I was much interested by finding, here, near the base of the exposure, well-marked strata of the inferior Silurian system, corresponding, in age, to the Blue Limestone of Cincinnati and the Hudson River group of the New-York series. The following fossils were procured from these beds: *Orthis testudinaria* (Dalman), *O. occidentalis* (Hall), *Rhynconella capax* (Conrad), *Rhynconella* (a species of the Blue Limestone of Cincinnati), *Streptelasma cornicula?* (Hall), and columns of Crinoids.

In following the windings of the Pass, we first descended over thick deposits of loose and partially consolidated detritus, after which nothing was encountered but granite and limestone. The surface is generally hilly, and slopes towards the Rio Grande, which is, here, of moderate depth, and flows over a rocky bed.

From this point to Doña Ana, the course of the Expedition was nearly north, pursuing the valley of the Rio Grande, which varies greatly in width, and is characterized by dark, rich, alluvial soil, bearing a luxuriant vegetation. From the east, the surface slopes towards the Rio Grande, and the western border is marked, for the first few miles above El Paso, by rugged mountains of granite and porphyry, and afterwards, by precipitous bluffs, which form the eastern edge of an elevated *mesa*. The soil is frequently encrusted with efflorescences of common salt and soda. The river has an average width of about one hundred yards. The water is moderately deep, and highly charged with fine yellow sediment. The El Paso Mountains exhibit the same general appearance and mineralogical composition as before. The limestone of the Lower Silurian system is seen strongly upheaved against the western base, until we reach a point ten or eleven miles north of the place where it was first discovered, when it disappears, and is succeeded by strata of the Carboniferous system, which are exposed, in places, to the thickness of about three hundred feet. Black ferruginous sand was observed in several localities near the base of the mountains, and the indications were such as to lead to the belief that this region may be found rich in valuable metals.

Palæontology.—Many of the organic remains of the upper division of the Cretaceous system have been described by Dr. Ferd. Rœmer, in his excellent and finely illustrated work on the Cretaceous strata of Texas. We are able, however, considerably to augment the list by the addition of a number of new and interesting forms, which have been placed in the hands of a Palæontologist for examination and description. We will, therefore, at present, merely enumerate some of the species which have been found most characteristic of the mass.

The following species have been found to range from the top to the base of the formation, viz: *Gryphæa Pitcheri* (Morton), *Exogyra arietina* (Rœm.), *Janira Texana* (Rœm. sp.) *Janira quadricostata* (Sowerby), and *Terebratula Wacoensis* (Rœmer).

In the upper part of the formation, we find most commonly the following, and, as far as our observations extend, they are peculiar to it: *Ceratites* (*Ammonites*) *pedernalis* (Rœm. sp.), *Pterodonta subfusiformis* (Shum.), *Pleurotomaria crotaloides* (Morton), *Scalaria vertebroides?* (Morton sp.), *Natica* (*Globiconcha*) *tumida* (Shum.), *Natica elevata* (Shum.), *Monopleura Texana* (Rœm.), *Lima Wacoensis* (Rœm.), *Ostrea crenulimargo* (Rœm.), *O. carinata* (Lamarck), *Panopæa Texana* (Shum.), and *Astrocœnia Guadalupae* (Rœm.)

In the inferior strata, the most characteristic forms are *Ammonites vespertinus* (Mort.), *A. Popeanus* (Shum.), *Turrilites Brazoensis* (Rœm.), *Baculites asper* (Mort.), *Exogyra costata* (Say), *E. arietina* (Rœm.), *E. læviuscula* (Rœm.), *Ostrea vesicularis* (Lam.), *Gryphæa Pitcheri* (Mort.), *Pecten* (sp. undet.), *Janira quadricostata?* (Sow.), *Inoceramus Cripsii* (Mant.), *I. mytiloides* (Mant.), *Inoceramus* (species undet.), *Pholadomya elegantula* (D'Orb.), *Cardium elegantulum* (Rœm.), *Cassidulus æquoreus* (Rœm.), *Terebratula Choctawensis* (Shum.), *Nerinea Texana* (Rœm.), and *Trigonia* (nov. sp.)

It will be seen from the above list of species, that, with some few exceptions, the fossils of the superior and inferior portions of the Upper Cretaceous strata of Texas and New Mexico are quite distinct. Nevertheless, as we cannot draw a well-marked horizon by lithological characters, we have thought proper to make no separation of the strata.

Notice of New Fossils from the Permian Strata of New Mexico and Texas, *collected by* Dr. George G. Shumard, *Geologist of the United States Government Expedition for obtaining Water by means of Artesian Wells along the 32d Parallel, under the direction of Capt.* John Pope, *U. S. Corps Top. Eng.*

BY B. F. SHUMARD, M.D.

[*Read March* 22, 1858.]

Productus Popei, *N. sp.*

Shell of medium size, subquadrate, wider than long, greatest width at the cardinal border. *Dorsal valve* (receiving valve) gibbous, very strongly arched, somewhat enrolled, flattened convex near the beak; anterior prolongation of moderate length, forming a gentle curve from the visceral region to the front; sinus commencing near the beak, where it is very shallow, but it soon increases in depth, and becomes very profound on the anterior prolongation, so as to give this portion of the shell a very marked bilobed appearance; *surface* with from six to ten unequally rounded, coarse ribs on each side of the sinus, their number sometimes increased by division and implantation. These ribs are usually quite prominent and broad on the anterior prolongation, but on the posterior third of the shell they become obsolete, leaving a nearly smooth surface for some distance before the beak; sides falling abruptly to the margins, near which they are usually marked with a series of eight or nine rather strong tubes, which extend from the beak to the front. Besides these, most of the specimens exhibit a few smaller tubes, sometimes scattered promiscuously over the surface, but generally ranging in oblique lines across the dorsum of the shell; beak small, pointed, slightly incurved, and passing a little beyond the cardinal margin; *ventral valve* elliptico-subquadrate, gently concave or flattened on the visceral disk, its sides with a row of spines, which, with other surface ornaments, correspond to those of the opposite valve.

We dedicate this, one of the most beautiful species of the American *Productus*, in compliment to Capt. John Pope, of the U. S. Corps Top. Eng., whose Expedition has the honor of having first procured palæontological evidence of the existence of Permian Strata in New Mexico and Texas.

PRODUCTUS MEXICANUS, *N. sp.*

Shell of medium size, subrectangular, width greater than the length; *dorsal valve* elevated, strongly arched, marked with a broad, very slight mesial depression, which is scarcely developed into a sinus; *sides* rounded, falling abruptly to the margins, front very gently convex; *beak* small, pointed, convex, moderately prominent; *surface* ornamented with from eighteen to twenty-four prominent, rounded, longitudinal ribs, their number somewhat increased by implantation or bifurcation. The ribs are separated from each other by spaces as wide as themselves, and both ribs and spaces are crossed at somewhat irregular intervals by rounded concentric folds, which give to the ribs at the points of crossing a handsome subnodulose character. The concentric folds are not as prominent as the ribs except on the sides, where, in one of the specimens before us, two or three of those nearest the border are developed into strong wrinkles. *Ventral valve* unknown.

Dimensions.—Length, 0.64; width, 0.70; height, 0.54. These proportions were taken from a young specimen on account of its being more perfect than the others. The collection contains fragments of full-grown shells, which, if perfect, would perhaps measure one-third greater.

White Limestone of the Guadalupe Mountains.

PRODUCTUS PILEOLUS, *N. sp.*

Shell small, strongly arched, gibbous, outline approaching to subquadrate, length greater than the width, widest at the cardinal margin. *Dorsal valve* gibbous, without mesial sinus, sides and front rounded, terminating below in a projecting band or rim, which is rounded and extends to the cardinal edge; *umbo* prominent, somewhat flattened anterior to the beak, slopes falling rather abruptly to the ears; *beak* prominent, rounded, strongly incurved, passing beyond the cardinal border; *ears* triangular, of medium size, incurved at the cardinal edge, convex in the middle and depressed at their junction with the umbones; surface of visceral region marked with several slightly elevated, concentric folds, which are most prominent on the sides and are continued on the ears, where they are directed backwards and become obsolete before reaching the cardinal edge; anterior prolongation smooth or marked with very obscure concentric folds.

The collection contains but one specimen of this little species and this is partially deprived of its test.

Dimensions.—Length, 0.36; width, 0.32; height, 0.24.

Occurs in the White Permian Limestone of the Guadalupe Mountains.

PRODUCTUS SEMIRETICULATUS, *Mart. sp.*

This widely distributed species is contained in Capt. Pope's collection from the White Limestone of the Guadalupe Mts. The specimens resemble most the variety *P. antiquatus*, but the sinus of the receiving valve is more profound and narrower than in the example figured by De Koninck, which are generally marked with a broad shallow sinus. One of our fossils exhibits a group of fifteen tubes on a smooth space just under the reticulated portion of the sides, arranged as represented in De Koninck's figures of some examples from Vise, Belgium. (*Monog. Prod. et Chon.*, pl. IX., fig. 1 *b*, *c*.)

AULOSTEGES GUADALUPENSIS, *N. sp.*

Ventral valve large, outline subelliptical, gibbous, flattened convex at the umbo, enlarging rapidly from beak to front and forming a pretty regular curve in the same direction; greatest width about the middle of the valve; lateral margins rounded, front slightly sinuate; a broad, shallow sinus commences some distance in advance of the beak and continues to the front in one of the specimens, and in the other the sinus is somewhat profound and narrow on the umbonal region and becomes shallow towards the front; *beak* elongated, flattened, straight or slightly curved upwards at the extremity, which is pointed; area triangular, very much elevated; lateral edges sharp and strongly defined. *Surface* marked with numerous slightly prominent, radiating, interrupted ribs, crossed by obscure, rounded, concentric ridges, which give to the former a subnodulose character; intervals marked with small circular pits, probably the points of attachment for spines. *Dorsal valve* unknown.

Dimensions.—Length of ventral valve, 1.40; width, 1.48; height, about 0.59.

This shell is very interesting as no species of the genus has heretofore been observed in American strata. In Europe it has not been found below the Permian.

Geol. Pos. & Loc.—White Limestone of the Guadalupe Mts., New Mexico and Texas.

SPIRIFER MEXICANUS, *N. sp.*

Shell rather large, broad ovate, moderately gibbous in young age, extremely so in full-grown specimens, greatest gibbosity near the middle, length and breadth nearly equal, cardinal margin considerably less than the greatest width, which is found near the middle of the smaller valve, lateral margins rounded, front sinuate. *Ventral valve* (receiving valve) regularly arched, much more prominent than the opposite one, having a deep narrow sinus extending from beak to front, sides rounded, cardinal margin equal to about one-half the width of the valve, cardinal angles rounded and obtuse; beak prolonged, elevated, incurved, pointed at extremity; *area* small, triangular, concave, arcuated, longitudinally striated, sides forming an angle of about 76°, deltoid opening a little wider than long. *Dorsal valve* broad elliptical, regularly convex, gibbous in full-grown specimens; *beak* small, pointed, incurved and slightly passing the cardinal border; *area* narrow, its margin gently arcuate. Surface marked with rounded, irregular, radiating, usually trifurcate ribs, which are indistinct on the lateral margins; they are separated by shallow furrows, and the number on the border amounts to from 18 to 24, on each side of the mesial sinus.

The dimensions of a young specimen are: Length and width, 0.76; thickness, 0.48. Of a full-grown individual: Length and width, about 1.34; thickness, 0.98.

Abundant in the White Guadalupe Limestone of Permian age, Guadalupe Mts., New Mexico and Texas.

SPIRIFER SULCIFERA, *N. sp.*

Shell rather small, ovate, subpentagonal; length about one-fifth greater than the width; greatest transverse diameter near the middle; cardinal extremities slightly auriculated. *Ventral valve* (receiving valve) gibbous, more prominent than the opposite one, greatest convexity a short distance behind the beaks; mesial sinus distinct, commencing at the point of the beak and increasing gradually in breadth and depth to the front; *area* broad, triangular; lateral margins sharply rounded; deltoid aperture rather large, triangular; surface marked with six broad, rounded, prominent folds, those next to the sinus being double the size of the others; ribs bearing one or more shallow longitudinal sulci, which become entirely obsolete before reaching the beak; intervals marked with obscure longitudinal striæ. *Dorsal valve* semi-elliptical, convex, a little longer than wide; mesial fold moderately elevated, having a distinct median groove extending its whole length, and on either side a broad sulcus, which bears one or more slender, slightly prominent, rounded ribs; intervals marked with longitudinal striæ as in the opposite valve. Under a magnifying glass, the surface exhibits very fine, concentric lines of growth.

Dimensions.—Length, 0.66; width, 0.57; height, 0.39; length of dorsal valve, 0.48; height of same, 0.16.

Geol. Pos. & Loc.—White Guadalupe Limestone, occupying the same geological position as the preceding species.

Spiriferina Billingsii, *N. sp.*

Shell of moderate size, wider than long, gibbous, cardinal line less than the width of the shell, extremities rounded. *Ventral valve* gibbous, strongly arched, marked with a deep, moderately broad, angular sinus, extending from tip of beak to front, sides convex; beak prominent, prolonged, rather sharply incurved, extremity pointed; *area* well developed arcuate, broad triangular, lateral edges rounded, deltoid aperture large. Surface with from six to eight prominent, rounded ribs on each side of the sinus; they are simple and gradually enlarge from the beak to the margins. *Dorsal valve* semi-elliptical, convex, having five or six prominent ribs on each side of the mesial fold, which is angulated, rather broad, and towards the front much elevated above the general convexity; cardinal line straight, or very slightly angulated; beak scarcely passing the cardinal line. The surfaces of both valves are thickly studded with extremely fine granulæ and delicate lines of growth.

Dimensions.—Length, 0.74; width, 0.90; thickness, 0.58. Length of dorsal valve, 0.44; thickness of ventral valve, 0.36.

This species is very similar to *S. cristata* (Schlot. sp.), to which we at first were disposed to refer it. Our shell is, however, larger, the beak more elongated, and the area narrower and higher.

The specimens in the collection obtained by Dr. G. G. Shumard are from the White Limestone of the Guadalupe Mts., the dark limestone subordinate to the White Limestone, and the Quaternary Conglomerate at the mouth of Delaware Creek, New Mexico.

Dedicated to E. Billings, Esq., Palæontologist of the Geological Survey of Canada.

Retzia papillata, *N. sp.*

Shell small, ovate, longer than wide, gibbous, front and sides rounded, valves nearly equally convex; *surface* marked with numerous extremely fine papillæ, each valve having eleven or twelve well-rounded, prominent ribs, those on the sides curving rather strongly to the margins and their number increased by insertion; intervals between the ribs rather deep, and as wide, or wider, than the ribs. *Ventral valve* without sinus, regularly convex, most prominent between the beak and the middle; cardinal edge straight and very short; *area* small, slightly arcuate, well defined by a sharply angulated margin; *beak* elongated, incurved extremity truncated, having a large circular foramen. *Dorsal valve* broad ovate, strongly and pretty regularly arcuate from beak to front;

cardinal margin very short, straight, forming an obtuse angle with the sides; *beak* small, strongly incurved, and passing a little beyond the cardinal line.

Dimensions.—Length, 0.40; width, 0.32; thickness, 0.27. Length of dorsal valve, 0.36.

This shell differs from the *Retzia punctilifera* (*nobis*) in having fewer ribs, and a smaller cardinal area.

Its geological position is in the dark limestone immediately under the White Limestone of the Guadalupe Mountains, New Mexico and Texas.

Retzia (?) Meekana, *N. sp.*

Shell rather small, ovate, gibbous, length slightly greater than the width, valves nearly equally convex, umbonial slope flattened, anterior portion of sides and front regularly rounded, surface of each valve marked with from eight to ten prominent, radiating plications, rounded for some distance from the beak, but becoming subangular towards the front; they expand very gradually from their origin to the borders, and are separated by rather deep sulci, as wide as themselves. The sides of the ribs are each marked with three or more small ribs, which are usually quite distinct at the borders of the valves, but become obsolete before reaching the beaks; shell structure finely punctate. *Ventral valve* (receiving valve) without any trace of mesial sinus, greatest convexity near the middle; *area* very small; *beak* moderately prolonged, rounded, incurved. *Dorsal valve* elevated near the beak; umbo rounded, sides somewhat flattened; cardinal margin short; beak moderately prominent, strongly incurved.

Dimensions.—Length, 0.46; width, 0.42; height, 0.36.

Geol. Pos. & Loc.—The specimens of the collection are marked, White Limestone, Guadalupe Mts.; dark limestone under White Limestone, Guadalupe Mts., and Conglomerate near mouth Delaware Creek, New Mexico.

Rhynconella Guadalupæ, *N. sp.*

Shell subtriangular with the angles rounded, convex, wider than long; lateral margins nearly straight, converging at an angle of about 85°; sides presenting a large, well-defined, elliptical, concave, or flat, smooth area, which is carinated at the commissure of the valves, and extends from the beaks nearly to the front; front strongly or slightly sinuate. *Ventral* (*receiving*) *valve* not as prominent as the opposite one; umbonal region flattened convex, having a broad, shallow mesial sinus extending from beak to front, lateral edges gently arcuate; *beak* flattened convex, rather strongly incurved. *Dorsal valve* presents a regularly convex and rather gentle curve from beak to front, and a low, broad mesial elevation, which is scarcely perceptible except near the front; *beak* depressed, gently convex and closely incurved. *Surface* marked with numerous rather coarse, rounded, radiating striæ, their number increased by bifurcation and insertion. The bifurcations generally take place near the beak. At the border the number of striæ amount to from thirty to thirty-five on each valve.

Dimensions.—Length, 0.58; width, 0.76; thickness, 0.48.

A handsome species, and quite characteristic of the White Limestone of the Guadalupe Mts. of New Mexico and Texas.

CAMARAPHORIA (?) BISULCATA, *N. sp.*

Shell variable, outline varying from nearly circular to subpentagonal, with angles obtusely rounded, sometimes very gibbous and sometimes moderately so, usually a little transverse, sides always rounded, front sinuate; shell structure fibrous. *Ventral* or *receiving valve* very depressed, gently convex, greatest convexity near the beak; cardinal margins forming an obtuse angle; mesial sinus broad at the front, scarcely reaching the middle of the valve, shallow, or rather deep, perfectly smooth, or bearing from two to five obscure, rounded ribs; tongue of sinus moderately produced, broadly truncate at extremity, and curved upwards, sometimes at nearly a right angle with the general surface of the valve; *beak* imperforate, pointed, incurved nearly in contact with the opposite valve. *Dorsal valve* strongly rounded in most specimens, much more gibbous than the opposite valve, marked with a broad, shallow depression or false sinus extending from beak to front, which is bounded on either side by a ridge very obscure on the rostral half of the shell, but forming together a broad mesial fold towards the front, which is smooth, or marked with two or more slightly prominent plications; beak rounded, obtuse, extremity usually hidden by the beak of the opposite valve.

Dimensions of an average specimen: length, 0.58; width, 0.63; height, 0.35.

Resembles *Terebratula superstes*, Verneuil, from which it is distinguished by the greater convexity of the dorsal valve, and its more flattened ventral valve.

Restricted to the dark limestone of Permian age at the base of the White Limestone of the Guadalupe Mountains; found also abundantly in the Conglomerate at the mouth of Delaware Creek, New Mexico.

PHILLIPSIA PERANNULATA, *N. sp.*

Pygidium deltoid, as wide as long, elevated; *border* narrow, smooth, inflected behind, outer edge sinuate, inner edge obtusely subangulated, the anterior two-thirds marked with a shallow furrow; *posterior extremity* narrow, very strongly arched; *axal lobe* elevated, nearly as wide as one lateral lobe, tapering very gradually from front to posterior extremity, which is bluntly rounded and nearly terminal; *axal rings* from twenty-eight to thirty, rounded, distinct on the dorsum, becoming obsolete on the sides, margins sinuate, surface of each ring studded with a single row of four or five granules, the granules of one ring alternating with those of the adjoining ones, transverse furrows much narrower than the rings and not deeply impressed; lateral lobes arched, somewhat flattened superiorly; segments eight, subangulated, simple, gently arched forwards, posterior ones directed obliquely backwards, the last one being nearly parallel with the longitudinal axis; transverse furrows deep and rather broad; surface of rings garnished with a row of distinct granules.

Dimensions.—Length and width, 0.74; height, 0.28.

Geol. Form. & Loc.—White Limestone of Guadalupe Mts., New Mexico. The collection of the Expedition contains several examples of the pygidium of this species.

FUSULINA ELONGATA, *N. sp.*

Shell nearly cylindrical, very slender and much elongated, pointed at the extremities, which are slightly curved; chambers very numerous; aperture very narrow, linear, extending the entire length. *Surface* covered with fine, somewhat flexuous striæ.

Dimensions.—Length, from one to two inches; width, from one to two lines. This species is at once distinguished from **F. *cylindrica*** **by its remarkable length.**

Occurs in the White Limestone, Dark Limestone, and Sandstone, of the Guadalupe Mts. of New Mexico and Texas.

An Hypothesis concerning the formation of Hail.

BY SPENCER SMITH.

Meteorologists were long since convinced that hailstones, while in the process of formation, must be retained in the atmosphere a much longer time than they would occupy in falling freely. The reasons upon which they have based this conclusion, are the great size to which these stones often attain, and their rounded and amorphous form, so different from

from beak to front, and a low, broad mesial elevation, which is scarcely perceptible except near the front; *beak* depressed, gently convex and closely incurved. *Surface* marked with numerous rather coarse, rounded, radiating striæ, their number increased by bifurcation and insertion. The bifurcations generally take place near the beak. At the border the number of striæ amount to from thirty to thirty-five on each valve.

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Shell variable, outline varying from nearly circular to subpentagonal, with angles obtusely rounded, sometimes very gibbous and sometimes moderately so, usually a little transverse, sides always rounded, front sinuate; shell structure fibrous. *Ventral* or *receiving valve* very depressed, gently convex, greatest convexity near the beak; cardinal margins forming an obtuse angle; mesial sinus broad at the front, scarcely reaching the middle of the valve, shallow, or rather deep, perfectly smooth, or bearing from two to five obscure, rounded ribs; tongue of sinus moderately produced, broadly truncate at extremity, and curved upwards, sometimes at nearly a right angle with the general surface of the valve; *beak* imperforate, pointed, incurved nearly in contact with the opposite valve. *Dorsal valve* strongly rounded in most specimens, much more gibbous than the opposite valve, marked with a broad, shallow depression or false sinus extending from beak to front, which is bounded on either side by a ridge very obscure on the rostral half of the shell, but forming together a broad mesial fold towards the front, which is smooth, or marked with two or more slightly prominent plications; beak rounded, obtuse, extremity usually hidden by the beak of the opposite valve.

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Occurs in the White Limestone, Dark Limestone, and Sandstone, of the Guadalupe Mts. of New Mexico and Texas.

An Hypothesis concerning the formation of Hail.

BY SPENCER SMITH.

Meteorologists were long since convinced that hailstones, while in the process of formation, must be retained in the atmosphere a much longer time than they would occupy in falling freely. The reasons upon which they have based this conclusion, are the great size to which these stones often attain, and their rounded and amorphous form, so different from the beautiful crystalline snow,—nay, the absence of all crystallization, showing that they are not formed from vapor or water at rest. On the contrary, they usually have the appearance of a series of aggregations. Some contain a nucleus of snow, while others are a mass of ice throughout. We are, however, so familiar with their general appearance, that further description is unnecessary. That any incontrovertible theory respecting the manner in which hailstones are thus aggregated in the atmosphere, can in the present state of meteorological science be proposed, is hardly to be expected. The most that will now be attempted, will be to show that the theory heretofore received as very nearly, if not quite, the true one, is, if not impossible, at least open to very grave objections. I proceed then to state another, perhaps, in its turn, to be proved no better founded than its predecessor.

While the young science of Electricity was at the zenith of its novelty, and every new electrical toy was astonishing the savans of Europe, Volta proposed to explain the formation of hailstones, on the principle which governs the action of the dancing balls and images between two metallic plates. He supposed two strata of clouds to be in opposite states of electricity, so that the hail formed in the upper, and then falling to the lower, would there become similarly electrified; thrown back again, in obedience to the attraction of the upper cloud, it was again cast into the lower cloud, and so on, until the momentum of the ball carried it, through the lower one, to the earth; or, if the clouds were side by side, the hail would be thrown from one to the other, as it fell. Now, although this hypothesis is somewhat plausible at first view, I think it will hardly bear the test of philosophical scrutiny.

We can hardly conceive of a cloud charged with electricity, of such tension as to arrest and throw back a lump of ice weighing four ounces, or even materially to alter its course, after it has fallen a few feet only. Again, ice, though capable of being electrified when dry, is not easily so when wet, which it most certainly would be while passing through the clouds. Here, then, are two of the objections to this hypothesis. That it is a theory so generally received, is probably owing to its having been advanced when every new discovery in electricity excited the wonder and astonishment of both the learned and the unlearned, and also when many phenomena in nature, inexplicable by other means, were very conveniently ascribed to its agency. Without, however, making any pretensions to accurate observations in Meteorology, or supposing that I can bring forward an hypothesis not liable to objections, I may be permitted to offer a few observations upon two storms which I have studied with some care. Of these, one occurred at Vergennes, Vt., on the 22d of July, 1829; and the other, at this place, in 1852.

I have selected these merely because they exhibited the general characteristics, common to all such storms, in a striking manner; and as like results usually follow from like causes, we may presume that the facts in one case will, with little variation, apply to all similar cases. A brief description of that in 1829, will be sufficient to present the principal facts illustrative of the proposed hypothesis. It commenced about four o'clock in the afternoon of a very hot, sultry day. Just before the hail began to fall, there was a violent wind, in its upward tendency resembling a whirlwind. The dust of the streets seemed carried upward, rather than onward, as if rushing to a vortex, the centre of which was in the clouds. But this passing gust nearly ceased before the hail began to fall, which it continued as usual to do for a few minutes only. Upon breaking open some of the hailstones which fell during the storm, they were found to contain particles of dust. As to size, they have seldom, if ever, been surpassed, several measuring from six to ten inches in circumference, and weighing from four to six ounces. The majority of them did not exhibit the usual snowy nucleus, but were one mass of ice throughout. Some of the largest were very irregular in shape, appearing to be made up of aggregations of smaller ones. Others looked like a snowball coated with ice. This storm passed over but a small territory, a strip about six miles wide and twenty long. The one which took place here in 1852, exhibited all the general characteristics of that already spoken of. It occurred at about the same time of day, was attended by the same violent wind with its upward rush, and also continued for a few minutes only. The hailstones presented the same aggregate form, but were not so large. Now, I have observed that great electrical disturbance of the atmosphere, together with the peculiar wind which I have mentioned, always accompany hailstorms. I account for these circumstances thus:—The passage of clouds, oppositely charged, near each other, gives rise to discharges of electricity, which cause a vacuum, and, as the adjacent parts rush together, thunder is produced. This rushing in of the air, then, accounts for the wind, and, as will hereafter be shown, the discharge of electricity is from below, upward. The circumstances under which hailstorms ordinarily occur, we suppose to be the following:—At the close of a hot, sultry day,—for hail usually falls in the afternoon, and rarely, if ever, at night,—a cloud in the upper regions of the atmosphere passes over a lower one which is already highly charged by evaporation from the earth; a discharge from this to the upper one takes place, and, a vacuum being produced, the warm vapor from the lower cloud is carried to a higher and colder position, where it is rapidly condensed into hail. These stones, prevented from falling by the strong upward current, continue to increase in size, both on account of the condensation of vapor, and of their coming in contact with each other; while being covered with water they congeal, and thus take on the ragged form which they sometimes present. The process is conceived to be much the same as that of making shot in our modern shot-towers. These, instead of being carried to a great height, as was formerly done, are now only about thirty feet high, and the drops of melted lead are made to fall slowly by means of a strong blast of air introduced into the base of the tower through large bellows. This current of air retains the molten drops until they are thoroughly cooled. That large lumps of hail, then, are formed by a similar process, seems highly probable for several reasons.

Hailstorms almost always occur in hot weather, towards the close of the day. Rapid evaporation generates electricity—as is seen in the hydro-electrical machine—and sudden condensation sets it free. We readily understand the formation of hail from a vapor-laden cloud being carried rapidly upward into colder regions. But Volta's theory supposes hail to be formed in the upper region first. If this were so, the warmer vapor of the lower cloud would tend to diminish rather than to increase the size of the hailstones. Now, I conceive that the passage of a current of electricity through the atmosphere would, by causing rapid expansion, generate great cold. The small hail first formed, being tossed about in this cold current, would, on coming in contact with each other, be quickly congealed together, thus deriving their aggregated form.

Such is the somewhat crude hypothesis which, from the limited observations that I have made, seems probable. If the attention of meteorologists shall hereafter be drawn to this subject, more facts may be gathered contributing either to establish or to falsify it. The presence of particles of dust in hailstones is, I believe, not uncommon; and if this fact can be well-established, in a majority of cases it will, I think, go far to illustrate their origin. It is generally conceded too, that atmospherical electricity and hailstones are closely related as cause and effect; but their exact relations, in this respect, must be left for future observation to determine.

METEOROLOGICAL OBSERVATIONS FOR 1856, MADE IN ST. LOUIS * BY DRS. ENGELMANN AND WISLIZENUS.

MONTHS.	BAROMETER, Reduced to Freezing Point. Monthly mean of daily observations at 7, 2 and 9 o'clock.	Highest.	Lowest.	Range.	THERMOMETER. (Fahrenheit.) Monthly mean of daily observ. at 7, 2 & 9.	Monthly mean of daily observations at sunrise and 2 P.M.	Highest.	Lowest.	Range.	EVAPORATION.† Monthly mean.	RELATIVE HUMIDITY. Monthly mean. ‡	QUANTITY OF RAIN AND SNOW. Monthly mean in inches.	PREVAILING WINDS. Monthly mean.	CLEARNESS OF SKY. ‖ Monthly mean.	THUNDERSTORMS.
Jan.	29.621	30.062	29.082	0.980	20.1	20.0	51.5	–13.5	65.0	1.9	73	**1.03**	W.	4.3	
Feb.	29.467	29.944	28.887	1.057	26.6	26.9	55.0	**–15.0**	**70.0**	2.0	77	3.64	W. & S.	4.2	
Mar.	29.556	29.909	29.246	0.663	36.2	36.1	65.5	15.0	50.5	4.4	59	1.06	W. & N.	5.3	1
April	29.391	29.825	28.965	0.860	59.3	58.7	88.0	34.5	53.5	9.4	**48**	**6.35**	W. & S.	6.4	6
May	29.447	29.736	29.089	0.647	66.2	65.2	92.0	45.0	47.0	8.2	59	3.03	W. & E.	6.1	4
June	29.459	29.710	29.261	0.449	78.5	77.2	99.0	51.0	48.0	10.2	59	1.24	S. & W.	7.1	7
July	29.509	29.768	29.180	0.588	83.5	82.1	**102.5**	63.0	39.5	10.8	59	4.61	E.	4.5	4
Aug.	29.519	29.722	29.309	0.413	74.2	73.0	93.0	54.0	**39.0**	7.9	65	6.32	N.	4.0	4
Sept.	29.577	29.757	29.391	**0.366**	66.3	65.8	92.0	36.0	56.0	6.7	67	3.51	W. & S.	3.0	3
Oct.	29.586	30.352	29.139	1.213	66.3	60.0	85.0	29.0	56.0	6.3	67	2.10	S. & E.	4.9	
Nov.	29.601	**30.381**	29.008	1.373	40.6	41.3	75.0	19.0	56.0	3.7	69	4.90	W. & S.	4.6	
Dec.	29.613	30.296	**28.662**	**1.634**	29.6	34.7	55.0	4.0	51.0	1.4	**84**	4.29	W. & S.E.	5.1	
1856.	29.529	30.381	28.662	1.719	54.0	53.4	102.5	–15.0	117.5	6.1	62	42.08	W. & S.E.	5.0	29

* St. Louis, Missouri, is in Latitude 38d. 37m. 28s.; Longitude 90d. 15m. 39s (Nicollet.) The elevation of St. Louis above the Gulf of Mexico is, at low water mark of the Mississippi, 375 feet; at the City Directrix, 405.5 feet; and the Barometer, used for the Meteorological Observations, was placed, during the first half of the year, at an elevation of 76 feet, and, during the second half, at an elevation of 60 feet above the City Directrix.

† Or difference between the dry and the wet bulb of the Thermometer, in the open air.

‡ Calculated from the previous columns, 1 designating full saturation of the atmosphere with moisture; 50, half saturation; 100, entire dryness.

‖ In numbers from 0 to 10, 0 designating entire clearness of sky, 10 entire cloudiness.

METEOROLOGICAL OBSERVATIONS FOR 1857, MADE IN ST. LOUIS BY A. WISLIZENUS, M.D.

MONTHS.	BAROMETER, Reduced to Freezing Point.				THERMOMETER. (Fahrenheit.)					EVAPORATION. Monthly mean.	RELATIVE HUMIDITY. Monthly mean.	QUANTITY OF RAIN AND SNOW. Monthly mean in inches.	PREVAILING WINDS. Monthly mean.	CLEARNESS OF SKY. Monthly mean.	THUNDERSTORMS.
	Monthly mean of daily observations at 7, 2, and 9 o'clock.	Highest.	Lowest	Range.	Monthly mean of daily observ. at 7, 2 & 9.	Monthly mean of daily observations at sunrise and 2 P.M.	Highest.	Lowest.	Range.						
Jan.	29.824	30.345	29.351	0.994	19.3	19.3	45.5	**—12.5**	58.0	**1.4**	**80**	**0.41**	W.	5.9	
Feb.	29.605	**30.479**	28.926	1.553	41.8	41.9	74.5	5.0	69.5	2.7	77	**7.74**	S. & W.	6.1	3
Mar.	29.639	30.051	29.068	0.983	39.5	38.8	76.0	10.5	65.5	4.1	65	1.80	W. & S.E.	4.8	2
April	29.521	29.946	29.207	0.739	44.4	43.1	77.0	18.0	59.0	5.7	56	1.72	W.	**6.2**	
May	29.443	29.715	29.030	0.685	61.8	59.9	88.5	39.5	49.0	**9.3**	**51**	4.81	N. & S.W.	5.2	2
June	29.416	29.627	29.185	0.442	72.6	70.6	92.0	49.0	43.0	8.1	63	3.71	S.W.	3.8	5
July	29.518	29.707	29.337	0.370	79.5	77.6	**101.5**	56.0	45.5	8.8	65	2.82	E. & N.	**3.1**	2
Aug.	29.537	29.729	29.303	0.426	76.5	75.2	98.5	52.0	46.5	7.0	70	4.15	S.E.	4.0	2
Sept.	29.650	30.214	29.394	0.820	71.3	70.8	93.0	44.0	49.0	5.7	73	3.18	S.	4.5	6
Oct.	29.603	30.078	29.356	0.722	54.7	54.8	81.5	28.0	53.5	3.5	78	3.02	W. & E.	5.2	1
Nov.	29.535	30.136	**28.724**	1.412	39.1	39.2	67.5	11.5	56.0	2.3	79	3.80	W. & S.E.	6.0	1
Dec.	29.581	30.162	29.055	1.107	40.5	40.6	59.0	25.0	34.0	3.3	73	1.87	W. & S.E.	5.2	
1857.	29.572	30.479	28.724	1.755	53.4	52.6	101.5	—12.5	114.0	5.2	69	39.03	W. & S.E.	5.0	24

The Barometer was placed during the whole year at an elevation of 60 feet above the City Directrix.

PREVAILING WINDS IN ST. LOUIS, MO.,

BY DAILY OBSERVATIONS OF A. WISLIZENUS, M.D.

In 1856 (*by* 1098 *Observations*).

1856.	N.	E.	S.	W.	N.	E.	S.	W.
Jan.	13.0	16.0	18.5	45.5				
Feb.	12.5	15.0	24.0	35.5				
Mar.	28.5	15.0	13.5	36.0	54.0	46.0	56.0	117.0
April	11.0	21.5	28.0	29.5				
May	18.5	29.5	11.5	33.5				
June	9.5	15.5	40.5	24.5	39.0	66.5	80.0	87.5
July	22.5	30.5	21.5	18.5				
Aug.	32.5	23.5	15.0	22.0				
Sept.	13.0	10.5	29.0	37.5	68.0	64.5	65.5	78.0
Oct.	16.5	26.0	37.0	13.5				
Nov.	12.0	12.5	29.0	36.5				
Dec.	6.5	25.5	25.5	35.5	35.0	64.0	91.5	85.5
1856.	196.0 =0.18	241.0 0.22	293.0 0.27	368.0 0.33	196.0	241.0	293.0	368.0

NOTE.—The direction of the wind was observed daily at 7, 2 and 9 o'clock, and entered in eight points of the compass: N., E., S., W., N.E., S.E., N.W., S.W. At the end of every month, the four direct winds were counted each as *one*, and the four intermediate winds as *two halves*. A numerical proportion was thus obtained, strikingly similar in the two years.

In 1857 (*by* 1095 *Observations*).

1857.	N.	E.	S.	W.	N.	E.	S.	W.
Jan.	12.5	20.0	16.0	44.5				
Feb.	14.0	16.5	29.5	24.0				
Mar.	13.0	23.0	21.0	36.0	39.5	59.5	66.5	104.5
April	14.0	19.0	15.5	41.5				
May	28.5	14.0	26.5	24.0				
June	10.5	17.5	31.0	31.0	53.0	50.5	73.0	96.5
July	26.0	29.5	22.0	15.5				
Aug.	15.5	28.5	27.5	21.5				
Sept.	18.0	19.5	35.0	17.5	59.5	77.5	84.5	54.5
Oct.	18.5	27.0	15.5	32.0				
Nov.	7.0	21.0	24.0	38.0				
Dec.	16.0	23.0	21.5	32.5	41.5	71.0	61.0	102.5
1857.	193.5 =0.18	258.5 0.23	285.0 0.26	358.0 0.33	193.5	258.5	285.0	358.0

TRANSACTIONS

OF THE

ACADEMY OF SCIENCE OF ST. LOUIS.

JOURNAL OF PROCEEDINGS.

May 3, 1858.

The President, Dr. B. F. SHUMARD, in the chair.

Seven members present.

A letter was read from Edward H. Beebe, Esq., of Galena, Ills., acknowledging his election as a correspondent; also a letter from the Hon. F. P. Blair, Jr., dated April 19th, 1858, concerning the transmission of books.

The following works were laid upon the table:

Proc. of the Bos. Soc. of Nat. Hist., Vol. VI., April, 1858, *from the Society;* Rep. on Commercial Relations of the U. S. with Foreign Nations, Vol. II., Part II., Tariffs, Wash., 4to, 1857, *from the Hon. F. P. Blair, Jr.;* Report of Com. on Rights of the Hudson's Bay Company, 1857,—Rep. of Count de Rottermund on the Mines of Lakes Superior and Huron, July, 1857,—Essai sur les Insects et les Maladies qui affectent le Blé, par Emilien Dupont, Montreal, 1857,—Calendrier de l'Instruction Publique pour 1858; Extraits du Rapp. sur l'Exposition de Paris relativement aux Produits du Canada, Toronto, 1857,—Rep. of the Superint. of Education for Lower Canada, for 1850–1, Quebec, 1852, *from Capt. L. A. Huguet-Latour;* Proc. Acad. Nat. Sciences, Philadelphia, Jan. to March, 1858, *from the Academy;* Geol. Sur. of Canada—Rep. of Progress for 1853–4–5–6, Toronto, 1857, and Plans of Lakes and Rivers between Lake Huron and the river Ottowa, accompanying Geol. Rep. for 1855–6, *from Sir Wm. E. Logan, Provincial Geologist;* Annual Rep. of the Geol. Sur. of the State of Wisconsin for 1857, by Prof. E. Daniels, Madison, 1858, and Trans. of the Wisconsin State Agricul. Soc. for 1854–5–6–7, Vol. IV., Madison, 1858, *from I. A. Lapham, Esq.;* Sketches of Routes between Fort Laramie and Great Salt Lake—War Dep., 1858, (2 copies,) and Map of the Ter. of the U. S. from the Miss. River to the Pacific Ocean, compiled from Explorations of Lieut. G. K. Warren, Top. Engs., Maj. W. H. Emory, Top. Engs., and Capt. A. A. Humphreys, Top. Engs., U. S. A., ordered by the Hon. Secretary of War, 1854–5–6–7, *from Lieut. G. K. Warren;* Jour. Franklin Ins., Vol. XXXV., April, 1858, *from the Society;* Bulletin Mensuel de la Société Imp. Zool. d'Acclimation, Paris, Tom. V., No. 3, Mars, 1858, *from the Society.*

Dr. H. A. Prout read a paper, entitled "Second Series of Descriptions of Bryozoa from the Carboniferous Formation of the Western States, with a description of one species from the Devonian."

On motion, the paper was referred to the Committee on Publication.

Dr. B. F. Shumard presented a specimen of Petrified Wood, taken from the Artesian Well in N. Mexico under the direction of Capt. J. Pope, U. S. A.

Messrs. James S. Wilgus, Alfred J. Noble, and John Loughborough, were elected associate members.

May 17, 1858.

The President, Dr. B. F. Shumard, in the chair.

Nine members present.

Letters were read from Prof. A. Winchell, of the Univ. of Mich., 3d May, 1858, requesting copies of the Transactions; from the Leeds Phil. & Literary Soc., Dec. 8th, 1857; the "Zeuwsch Genootschap der Wetenschappz," 22 Nov., 1857; the "Société Linnéenne de Normandie," 24 Nov., 1857; the "Naturf. Gesellschaft in Emden," 22 Nov. 1857; and the "Société de Geographie," Paris, 26 Nov., 1857, acknowledging the receipt of the Trans. of the Academy.

Books received were laid upon the table, as follows: Rep. of the U. States and Mexican Boundary Commission, by Major W. H. Emory, U. S. A., Vol. I., Wash., 4to, 1857, (2 copies),—Fourth Meteor. Rept. of Prof. James P. Espy, Vol. I., Wash., 4to, 1857, (2 copies,) and Rep. of Explor. & Sur. of Pacific Railroad Routes, 1853–6, Vol. VII., Wash., 4to, 1857, *from the Hon. Trusten Polk;* Mémoires de la Soc. des Sciences Physiques et Naturelles de Bourdeaux, Tom. I., Cah. 1-2, 1854-5, *from the Society;* Trans. of the Literary & Phil. Soc. of Leeds, Vol. I., Part I., Lond., 1837,—Account of an Egyptian Mummy, presented to the Leeds Phil. & Lit. Soc. by John Bladys, Esq., by W. Osburn, Jr., F.R.S., Leeds, 1828,—Guide to the Museum of the Leeds Phil. & Lit. Soc. 1854,—37th Rep. of the Council of the Leeds Phil. & Lit. Soc., 1856-7,—Rep. of Proc. of the Geol. & Polytechnic Soc. of the West Riding of Yorkshire, 1856-7, Leeds, 1857, *from the Society;* Einundvierzigster Jahresbericht der Naturf. Gesellschaft in Emden für 1855,—Zweiundvierzigster Jahresb. of the same, for 1856,—Kleine Schriften der Naturf. Gesells. in Emden—Die Gewitter der Jahres 1855, von Dr. M. A. F. Prestel, Emden, 1856,—Der K. Naturf. Gesellschaft zu Moskau zur Feier ihres fünfzigjährigen Bestehens am 23 Dec. 1855, die Naturf. Gesells. zu Emden,—Die Temp. v. Emden, von Dr. M. A. F. Prestel, 1855, *from the Society;* Rep. on Coml. Relations of the U. States with Foreign Nations, Vols. I., III., & IV., Wash., 4to., 1856-7, *from the Hon. F. P. Blair. Jr.*

Mr. C. P. Chouteau presented a mass of meteoric iron, 35 lbs. weight, found in Nebraska Ter., about 20 miles from Fort Pierre; also, in the name of Col. A. J. Vaughan, a fine stuffed skin of the Grizzly Bear.

The thanks of the Academy were voted to the above named gentlemen for these valuable donations.

Mr. George D. Hall was elected an associate member.

May 31, 1858.

The President, Dr. B. F. Shumard, in the chair.

Thirteen members present.

Letters were read from S. Andrews, Ann Arbor, Mich., and from Wm. Sharswood, Phila., requesting copies of the Transactions of the Academy; also from Prof. Joseph Henry, Secretary of the Smithsonian Institution, concerning exchanges.

The following books were received: Jour. of the Franklin Inst., Phila., May, 1858, No. 5, Vol. XXXV., 3d Ser., *from the Society;* Proc. of the Bos. Soc. of Nat. Hist., Vol VI., April, 1858, *from the Society;* Rep. U. S. Coast Sur., 1856, Wash., 4to., *from the Hon. Trusten Polk;* Rep. of Explor. and Sur. of Pacific R. Routes, Vol. VII., Wash., 4to., 1857, *from the Hon. F. P. Blair, Jr.;* Kosmos, Zeitschrift für angewandte Naturwissenschaften, Nos. 1, 2, 3, January and March, 1858, Leipzig, *from Mr. Edward Bühler*.

The Committee appointed to frame an additional by-law defining the duties of the Committee on Publication reported the following, which was adopted:

ARTICLE I.

§ 7. The Committee on Publication shall be appointed by the President; and it shall be their duty to edit the publications of the Academy and superintend the printing thereof. The Transactions shall be published in numbers as often as the Academy may direct, in a suitable form to make up bound volumes of convenient size, and each number shall contain a digested abstract of the Journal of Proceedings prepared by the committee, together with all such original papers as shall have been reported by committees and ordered by the Academy for publication: but if, at any time, it shall happen that more matter has been ordered for publication than the proposed number will contain, or if the committee, in arranging the same for the press, shall doubt the propriety of including any paper, they shall report the fact to the Academy, when the President shall appoint a Committee of seven members, including the Committee on Publication, to consider thereof, and report in writing to the Academy what papers shall be taken, and what omitted, in the given number.

Messrs. J. M. Kershaw and Joseph S. McCune were elected associate members.

June 14, 1858.

The President, Dr. B. F. SHUMARD, in the chair.

Sixteen members present.

A letter was read from the Hon. Trusten Polk, U. S. Senator, in relation to books transmitted; and also, from the Rev. C. H. A. Dall, of Calcutta, acknowledging his election as a correspondent, and presenting a specimen of Fern from the foot of the Kinchinjunga peak of the Himalayas.

Laid upon the table: the Jour. of the Franklin Institute, for May, 1858, *from the Society;* Address at the Univ. of Penn. before the Society of the Alumni, Dec. 10th, 1856, by the Hon. George Sharswood, LL.D., Phila., 1857, *from the Author.*

Dr. H. A. Prout remarked, that he had discovered some new species of Bryozoa, mostly from the Falls of the Ohio, which he proposed to describe under the following names: *Semicoscinium rhomboideum*, *Ceramopora falcata; Eschara*, 3 new species; *Septopora*, a new subgenus of *Fenestella; Fenestella hemitrypa*, *F. tuberculata*, *Liriopora Kaskaskiensis.*

He would present a paper giving descriptions *in extenso*, at a future meeting.

A specimen of Spider (*Mygale*) was presented by Mr. Bender; and a specimen of Specular iron ore from Dent Co., Mo., by Messrs. Johnson and Colman.

June 28, 1858.

Dr. C. A. Pope in the chair.

Six members present.

The following letters were read: From the "Société Royale de Zoologie à Amsterdam, Nov., 1858, proposing to send to the Academy the "Recueil d'Observations Zoologiques," and requesting an exchange of publications; from Dr. Felix Flügel, Leipzig, March 5th, 1858, advising of the transmission of books and pamphlets; from the "Königl. Saechs. Bergakademie zu Freiberg," 13 Dec., 1857; the "Utrecht Society of Arts and Sciences," 7 Dec., 1857; the "Bataafsch Genootschap der Prœfundervindelijke Wijsbegeerte te Rotterdam," 14 Jan., 1858; the "Senckenbergische Naturforschende Gesellschaft in Frankfurt am Main," 24 Dec., 1857; the "Königl. Bayerische Akad. der Wissenschaften," Munich, 12 Dec.,1857; the "Naturforschende Gesellschaft," Basel, Switz., 10 Dec., 1857; the "Entomologische Verein," Stettin, 23 Dec., 1857; the "Verein für Vaterländische Naturkunde in Württemberg," Stuttgardt, 1 Jan., 1858; from Dr. F. H. Troschel, Prof. in the Univ. of Bonn, and Editor of the "Archiv für Naturgeschichte," Bonn, 10 Jan., 1858, acknowledging the receipt of No. 1, Vol. I. of the Trans., and transmitting publications in exchange. From the Trustees of the New York State Lib., 15 June, 1858; Librarian of Yale College, 16 June, 1858; Librarian of Harvard College, 17 June, 1858; Essex Institute, 21 June, 1858; Librarian of the Univ. of Mich., 22 June, 1858; and from the Secretary of the Smithsonian Institution, 19 June, 1858, acknowledging the receipt of No. 2, Vol. I., of the Trans. of the Academy.

The following publications were received and laid upon the table: Rep. of Explor. & Survs. of Pacific R. Routes, Vol. V., Wash., 4to., 1856, *from the Hon. Trusten Polk, U. S. Sen.;* Proc. of the Acad. of Nat. Sciences, Philad., for April, 1858, *from the Society;* Practical Dic. of the English and German Languages, Parts I. & II., Leipzig, 1857–8,—Beiträge zur Sprachenkunde von H. E. von der Gabelentz,—

Grammatik der Dakota-Sprache, Leip., 1852,—Zur Feier des 50 jährigen Doctorjubiläums des Herrn Isaac Jeitteles: von Dr. Wilh. Rud. Weitenweber, Prag, 1850,—Aus dem Leben und Wirken des Herrn Dr. Joh. Ph. Helds—Eine Festschrift, von Dr. Wilh. Rud. Weitenweber, Prag, 1847,—Deutsche Maasse, Münzen und Gewichte, von dem Herrn Prof. Dr. Gerling,—Rep. on the Comet of 1843, by Dr. von Boguslawski of Breslau, Lond., 1846,—Systematisches Verzeichniss der Böhmischen Trilobiten, mitgetheilt von Dr. Wilh. Rud. Weitenweber, Prag, 1857,—Erforschung der wahren Ursache des krankhaften Zustandes der Kartoffelpflanze, von M. Protz, Leip., 1853,—Verhandlungen des Vereines zur Beförderung des Gartenbaus in dem Königl. Preuss. Staaten, Jahrgang IV., Lief. 2–3, Berlin, 1857,—Literarische Sympathien oder industrielle Buchmacherei, von Dr. J. G. Flügel; nebst einem Vorwort von Prof. Dr. Gottf. Hermann, Leip., 1843,—Die englische Sprache in Nordamerika,—Arch. für das Studium der neueren Sprachen und Literaturen, IV. Band, 1848,—Die englische Philologie in Nordamerika,—Ein Beitrag zur Geschichte unserer Erde von L. Gr. von Pfiel, Berlin, 1853,—Ischel, by A. E. Mastalier, M.D., Leip., 1850, *from Dr. Felix Flügel;* Berichte des naturwissenschaftlichen Vereins des Harzes, für die Jahre, 1840–1, bis 1845–6, Wernigerode, 1856–'57, *from the Society;* Gelehrte Anzeigen der K. bayerischen Akad. der Wissenschaften, München, 1857, Vol. 44,—Ueber die Physik der Molecularkräfte, von Prof. Dr. Zolly, München, 1857,—Ueber die Gründung der Wissenschaft altdeutscher Sprache und Literatur, von Dr. Konrad Hofmann, München, 1857,—Almanach der Königl. bayerischen Akad. der Wissenschaften für das Jahr 1855, *from the Society;* Verhandl. der Naturforschenden Gesellschaft in Basel, Heft 1—4, 1854–7, *from the Society;* Physicalisch-medicinische Gesellschaft zu Würzburg—Sitzungs-Berichte für das Gesellschaftsjahr 1856–7, *from the Society;* Entomologische Zeitung, herausg. von dem Entomologischen Vereine zu Stettin, Jahrg. XVIII., Stettin, 1857, *from the Society;* Württembergische Naturwissenschaftliche Jahreshefte, XIV. Jahrg. Heft 1, Stuttgart, 1858, *from the Society;* Berichte über die Leistungen im Gebiete der Herpetologie während des Jahres 1854,—Bericht über die Leistungen in der Naturgeschichte der Säugethiere während der Jahres 1855, *from Dr. F. H. Troschel;* Rep. on Consumption of Cotton in Europe, by John Claiborne, Esq., Sen. Doc. No. 35 of the 35th Cong., 1st Sess., 1858, *from the Hon. T. Polk, U. S. Sen.;* Essay on the Relation of Atomic Heat to Crystaline Form, by J. Aitken Meigs, M.D., Phila., 1855, *from the Author;* Rep. on a Memorial of the Alumni of Dart. Coll., Boston, 1858,—Address before the Alumni of Dart. Coll., by Prof. S. G. Brown, Concord, N. H., 1856,—Catalogus Coll. Dartm., 1855,—Cat. of Dartm. Coll., for 1857-8, *from the College;* Catalogue of the N. Y. State Lib., 3 Vols., 1855-6,—Annual Rep. of Comptroller, Jan., 1858,—Meteor. Observations, 1826-1850, by Franklin B. Hough, A.M., M.D., Albany, 1858, *from the New York State Library.*

Dr. C. A. Pope presented a specimen of Sulphuret of Copper, from Mine La Motte; two molars of *Mastodon giganteus,* found in the State of Wisconsin; and a specimen of coral.

Thomas Kennard, M.D., was elected an associate member.

July 12, 1858.

The President, Dr. B. F. SHUMARD, in the chair.

Fifteen members present.

Letters were read from D. M. Johnson, Coshocton, Ohio, July 3d, 1858; from S. Andrews, Ann Arbor, Mich., 2 July, 1858; from Dr. N. B. Benedict, N. Orleans, 25 June, 1858, acknowledging receipt of Trans. No. 2; also, a letter from Joseph M. Kennedy, Washington, 3 July, 1858, offering to dispose of a collection of reptiles.

The following books were received: Jour. of the Franklin Institute, Phila., for July, 1858, *from the Institute;* Prodromus Descriptionis Animalium Evertebratorum, quæ in expeditione ad Oceanum Pacificum Septen., observavit et descripsit W. Stimpson, Part V., 1858, *from the Author.*

The mass of iron ore presented by Mr. Harrison, at a late meeting, and supposed to exhibit the structure of wood and marks of an axe, was referred to a committee consisting of Drs. Hilgard and Prout, with the request that they would examine the same and report thereon at a future meeting.

The Meteoric Stone presented at former meeting by Mr. Chouteau was referred to the Committee on Chemistry for examination and analysis.

Hon. James B. Colt, and Messrs. James R. Larkin, Richard Edwards, C. S. Pennell, and B. G. Farrar, were elected associate members.

July 26, 1858.

The President, Dr. B. F. SHUMARD, in the chair.

Ten members present.

A letter was read from the "Deutsche Geol. Gesellschaft," Berlin, 5 Nov., 1857, acknowledging the receipt of No. 1, Vol. I., of the Trans. of the Academy, and advising of the transmission of publications in exchange; also, a letter from A. F. Bandelier, Highland, Ills., 16 July, 1858, requesting copies of the Transactions, and proposing to send a collection of entomological specimens to the Academy; and from S. Andrews, Ann Arbor, Mich., 10 July, 1858, enclosing the price of Transactions received.

The following publications were received: Descriptions of two new species of North American Helicidæ, by Thomas Bland, New York, 1858, *from the Author;* New Orleans Med. and Surg. Jour., for July, 1858, Vol. XV., No. 4, *from the Editors;* Bulletin de la Société Philomathique de Bordeaux, 2d Sér., No. 2, 4 Trim., 1856,—Nos. 1, 2, 3, 4, 1857, *from the Society;* Kosmos, Zeitschrift für angewandte Naturwissenschaften, No. 4, April, 1858, No. 5, May, 1858, Leipzig, *from Edward Bühler;* Zeitschrift der Deutschen Geologischen Gesellschaft, Berlin, VIII. Band, Heft 1–4, IX. Band, Heft 1–2, 1856–7, *from the Society.*

Mr. J. C. Reid presented a specimen of Krematite, from the limestone overlying the coal in the Illinois Bluffs, nine miles from St. Louis; Mr. Cozzens, a specimen of Talc; Mr. DeBaun, a specimen of Arragonite; a botanical specimen from India was received from the Rev. C. H. A. Dall, Calcutta.

The President read a paper entitled "The Geological Structure of the 'Jornada del Muerto,' New Mexico, being an abstract of a portion of the Geological Report of the Expedition under Capt. John Pope, U. S. Top. Engs., for boring Artesian Wells along the line of the 32d parallel, by G. G. Shumard, M.D., Geologist of the Expedition." The paper was referred to a committee, consisting of Drs. B. F. Shumard and H. A. Prout.

Dr. T. C. Hilgard presented specimens of the branches and leaves of the common Cotton-wood tree, growing in the neighborhood of St. Louis, with a view of establishing the great variability of foliage within a single tree and species.

He remarked that, in the germinal plant, the leaves are ovate, and hardly acuminate, besides being crenately serrate in all ages. The angles of branches are partly very prominent, partly imperceptible, and the leaves vary from ovate to ovate-cordate acuminate, deltoid acuminate, and rhombic acuminate in the young leaves, as shown in the specimens. According to Gray's descriptions, these forms (occurring in one and the same individual) would not only comprise Populus monilifera, *Ait.* (synonyms, Pop. Canadensis, *Michaux*, Pop. lævigata, *Willd.*), but likewise Pop. angulata, *Ait.*, and perhaps P. balsamifera, *L.* (Balsam Poplar) and its variety, candicans (Balm of Gilead) with round branches, which we likewise find in our common Cotton-wood when full grown.

A similar relation seems to obtain between the assumed species of Celtis occidentalis, *L.*, and C. Mississippiensis, *Bosc.*, the latter being supposed by Gray to run into the former. These two forms, apparently corresponding to the description of foliage of either species—rough, lanceolate, serrate, and smooth, entire, acuminate—I have collected from the same individual trees, one at East St. Louis, the other at Milledgeville, Ga.

The two Rocky Mountain species figured by Nuttall seem to be mere varieties likewise, perhaps the more marked because separated from the rest of the stock by woodless prairies, so as not permit the local *varieties* to be *levelled* by fertile commixture.

Under any marked peculiarity of outward conditions, peculiar varieties will form: if not levelled by intercourse they will inveterate and have the appearance and bearing of a species. Should the time of florition of one variety deprive it of the possibility of commixture with another one, we should have an actual difference of species to all empiric effects and purposes. The actual mode of framing the species is, that it is made to comprise all individuals among which no typical difference can be established; so far as all characters are insensibly mediated, so far no difference of species can be established. Wherever fertile intercourse continues between different forms, we know by experience that all characters are gradually mediated. Hence, between individuals fertilely commingling into posterity, no difference of species can be established. It is thus that *species* stands in its actual universal sense of *kind*,—the *kind* being a sum of things, or things equal under the assumed point of view. The point of view in organic systems is inherent type, which comprises all types between which no definite distinction can be held, such as among congeners or derivations of the same stock.

How far members of the same species, nay, descendants of the same progenitors, may swerve in the final development of variety,—how deeply such characters may inveterate, and whether it may not extend to mutual infertility,—are questions yet to be examined. In the latter case, different species from the same ancestral stock may be anticipated.

The process of printing by natural self-impressions described in the publication entitled "Kosmos," and shown in this specimen of Quercus (*pedunculata* or *sessiliflora*), is no doubt destined to prove very useful in the investigation of similar questions. These specimens of cotton-wood leaves might at once be preserved for all time in all their peculiarity and variety of form.

The European Oak here represented exists under two forms considered specific, with pedunculate and with sessile fruit. Whether in Europe the transitions exist, I am unable with certainty to say; but I recollect to have been at a loss to decide for one or the other, in some cases, but have not preserved those doubtful specimens, probably the intermediate links of perhaps two varieties of one original stock met on the same ground; and which are now in process of an interchange rendered difficult by the scarcity of oak in central Europe, and the artificial rearing of its forests from selected seeds.

Of American forms, our Quercus alba resembles most this European species, as seen in these specimens. It would be interesting to trace all the forms of Europe to the nearest allied ones of Asia, of our Western coast and our Eastern woody region, as I do not think it improbable that thus an insensible connection by some primeval stock, perhaps fossil, of a pri-

Dr. Pope presented two specimens of Trilobite from the Niagara group, near the mouth of the Illinois River, at Grafton quarry; a molar tooth of *Mastodon giganteus*, and an Indian relic, being a small figure of the human head carved in stone, found near St. Mary's Landing, in St. Genevieve county, Mo., by Mr. Bernard Pratte.

Mr. Joseph Charless presented a Shark's tooth and a chambered shell allied to *Megasiphonia ziczac*, and other fossils, from the Eocene Tertiary, in the vicinity of the Zeuglodon bed near the town of Choctaw in Clarke county, Alabama.

Dr. Engelmann stated, that while on his recent visit in Europe, he had distributed the copies of the Transactions of the Academy sent to his address to scientific societies. He had received assurances from several societies and gentlemen, that they would send their publications in exchange for those of the Academy. He observed that he had met with good success in procuring the execution of engravings for his forthcoming report on the Cactaceæ of the United States and Mexican boundary, shortly to be published by Congress. He had enjoyed opportunities of examining many living species of Cacti, in different European collections, and a few species naturalized in Italy. He had derived especial pleasure in studying the unique collection of Prince Salm Dyck, at his chateau of Dyck, near Cologne. He had also made it an especial object to examine and compare the rich botanical collections in the capitals of Europe in regard to the numerous species of the intricate genera of Cuscuta and Euphorbia. He furthermore stated that he had the pleasure of acquiring for our public spirited fellow-citizen, H. Shaw, the extensive herbarium of the late Prof. Bernhardi of Erfurt, Germany, which is said to contain 40,000 numbers. This collection, together with many valuable works, the commencement of a Botanical Library, also bought by him for the "Missouri Botanic Garden," is now on its way to this city.

Mr. Charless remarked that he had seen a large Cactus, in full bloom, growing on the stump of an old oak near the sea coast, in the State of Mississippi.

It was voted to subscribe for the Atlas of Human Helminths, shortly to be published by Dr. D. F. Weinland.

G. S. Walker, M.D., was elected an associate member.

September 20, 1858.

Dr. Geo. Engelmann in the chair.

Fourteen members present.

August 23, 1858.

The President, Dr. B. F. SHUMARD, in the chair.

Twelve members present.

The following publications were laid upon the table: Some Experiments on Sonorous Flames, by Prof. Wm. B. Rogers, New Haven, 1858, *from the Author;* Illinois Geol. Survey, Rep. on Illinois Coals, with descriptions and analyses, by J. G. Norwood, M.D., State Geologist, Chicago, 1858, *from Edward Holden;* Jour. of the Bath and West of England Soc. of Agriculture, Arts, Manuf. & Com., vol. V. New Ser., Lond., 1857, *from the Society;* Notes pour servir à une Description Geologique des Montagnes Rocheuses, par Jules Marcou, Prof. à l'École Polytechnique fédérale, Genève, 1858, *from the Author.*

A letter was read from the Hon. F. P. Blair, jr., U. States House of Reps., requesting copies of the Transactions, which were ordered to be sent.

Dr. B. F. Shumard deposited in the Museum 300 species of Tertiary fossils, from Austria; Trilobites from the Lower Silurian of Bohemia; and fossils from the Trias of the Alps.

Dr. A. C. Koch deposited several specimens of fossil bones collected by him.

Dr. Sander presented, in the name of Mr. De Clausel, a living specimen of *Siren lacertina*, caught in the American Bottom after the flood of 1858.

September 6*th*, 1858.

The President, Dr. B. F. SHUMARD, in the chair.

Thirteen members present.

A letter was read from M. Alfred Malherbe, Metz, 5th August, 1858, with prospectus of his proposed "Monographie des Picidés," and requesting subscriptions in aid of the work. The matter was referred to the Committee on Library.

Publications received were laid upon the table, as follows: Human Cestoides, an Essay on the Tapeworms of Man, by D. F. Weinland, Ph. D., Camb., 1858. *from the Author;* Prospectus of the Mathemat. Monthly, by J. D. Runkle, Camb., 1858; New Orleans Med. & Sur. Jour. July, 1858, *from the Editors;* Jour. of the Franklin Inst. for June and July, 1858, *from the Institute.*

Dr. Pope presented two specimens of Trilobite from the Niagara group, near the mouth of the Illinois River, at Grafton quarry; a molar tooth of *Mastodon giganteus*, and an Indian relic, being a small figure of the human head carved in stone, found near St. Mary's Landing, in St. Genevieve county, Mo., by Mr. Bernard Pratte.

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G. S. Walker, M.D., was elected an associate member.

September 20, 1858.

Dr. Geo. Engelmann in the chair.

Fourteen members present.

A letter was read from Thomas Davidson, Esq., Sec. G. S. of London, acknowledging his election as a correspondent.

The following publications were received: Jour. of the Franklin Inst. for September, 1858, *from the Society;* Proc. of the Bos. Soc. of Nat. Hist., August, 1858, *from the Society;* New Orleans Med. & Sur. Jour. for Sept. 1858, *from the Editors;* Proc. of the Essex Institute, vol. II. Part I., 1856–7, *from the Society;* Bulletin de la Société Imp. Zoologique d'Acclimation, Tom. V., No. 8, Aout, 1858, Paris, *from the Society;* Prodromus Descriptionis Animalium Evertebratorum, &c., observavit et descripsit W. Stimpson, Part VI., *from the Author.*

Mr. Taylor Blow proposed to donate to the Academy a specimen of Lead ore, 1300 lbs. in weight in one mass, from the mines of South-western Missouri, provided the expenses of freight were defrayed.

The thanks of the Academy were returned to Mr. Blow for his generous offer, but the proposition was declined.

Dr. Stevens exhibited specimens of brown paper made of corn-stalks, broken, ground, and manufactured in the ordinary way. It compared well with the best quality of brown paper in common use.

Dr. Engelmann deposited in the Library the Annals of the Lyceum of Nat. Hist. of New York, vols. I.—IV.

Dr. E. also exhibited specimens of the fruit of the Osage Orange (*Maclura aurantiaca*), a native of the South of Missouri, Arkansas, and Texas, and now extensively cultivated here for hedges.

He exhibited several of the plates finely engraved on steel for his work on the Cactaceæ of the United States and Mexican boundary.

A committee was appointed, consisting of Dr. Engelmann and Mr. Holmes, to devise a suitable plan for labeling the specimens collected in the Museum, and to procure the necessary labels.

The Rev. S. B. McPheeters was elected an associate member.

October 4, 1858.

Vice-President, Dr. H. A. Prout, in the chair.

Five members present.

Letters were read from the Librarian of the British Museum, London, 5th Jan. 1858, and from the Literary and Phil.

Soc. of Manchester, Eng., acknowledging the receipt of No. I., Vol. I., of the Transactions of the Academy.

A letter was read from C. Witter proposing to sell to the Academy Goldfuss' "Petrefacten," with Plates; Gœppert's "Fossile Coniferen," and other works, at prices named. The matter was referred to the Library Committee.

The following works were received: Rep. of Explor. & Survs. of Pacific R. R. Routes, Vol. VIII., Wash., 4to, 1858, containing Prof. S. F. Baird's Report on the N. American Mammals,—*from the Hon. F. P. Blair, jr., U. S. House of Reps.;* Proc. of the Amer. Phil. Soc. Philad., Vol. VI., No. 59, Phil., 1858, *from the Society.*

An interesting collection of Hindu clay images were received from the Rev. C. H. A. Dall, of Calcutta, and deposited in the Museum.

October 18, 1858.

Dr. Geo. Engelmann in the chair.

Ten members present.

The following publications were received: On the Formation of Rotating Rings by Air and Liquids, under certain conditions of discharge, by Prof. Wm. B. Rogers, New Haven, 1858, *from the Author;* Jour. of the Franklin Inst., No. 4, Oct., 1858, *from the Society;* Proc. of the Acad. of Nat. Sciences, Philad., May—Sept., 1858, *from the Society.*

Dr. Engelmann, from the committee on the subject of labels, made the following report:

Your committee would beg leave to report that they have, after mature deliberation, come to the conclusion, to recommend to the Academy two kinds of labels, viz.: a small label, ½ inch square, or, for very small specimens, ¼ inch square, which is to be glued to the specimen; and a large label, 2½ inches long and 1½ inches broad, which may be attached to the specimen, or laid under it, according to its size and shape. The smaller labels are to be inscribed with a capital letter, (A, B, C, D, &c.,) representing the different departments of Mammals, Birds, Reptiles, &c.; and with a number for each letter from 1 onwards, following the date of acquisition by the Academy.

The larger labels are to be inscribed with corresponding letters and numbers, and with the name of the specimen, the locality where found, the date when obtained, and the name of the donor. The small labels are to be of different colors, viz.: white for the American specimens; blue for the European; yellow for the Asiatic; red for the African, and green for Oceanica. The white American label may be pure white for North America, and white with a black border for South America; and white with some other distinction for Missouri and Illinois.

On motion, the plan reported was adopted.

Mr. Holmes presented in the name of Mr. Geo. De Baun, Jr., a specimen of Crystaline Limestone, highly polished and resembling alabaster, from a quarry in Franklin County, Mo., about 2½ miles from the South-west Branch of the Pacific Railroad, where it is found in beds three feet in thickness. It appears to be well adapted for ornamental work, and can be obtained in large masses.

Nov. 1, 1858.

Vice President, Dr. H. A. Prout, in the chair.

Six members present.

A letter was read from E. Billings, Esq., F.G.S., Montreal, 15 Oct., 1858, acknowledging his election as a correspondent: also, a letter from the Canadian Institute, acknowledging receipt of the Transactions.

The following works were received: Rep. of Explor. & Surv. of Pacific R.R. Routes, Vol. VIII., Wash., 4to., 1857, *from the Hon. Trusten Polk;* Pat. Office Rep. for 1856, Vol. III., Mechanics, Wash., 1857, *from the Hon. F. P. Blair, Jr.;* Geol. Sur. of Canada—Figs. and Descriptions of Canadian Organic Rems., Dec. III., Montreal, 1858, *from the Geol. Survey;* Canadian Fossils—Description of some new genera and species from the Silurian and Devonian Formations of Canada, by E. Billings, Montreal, 1857, *from the Author;* Rep. on Chem. Analysis of White Sulphur Water of the Artesian Well of Lafayette, Ind., by Chas. M. Wetherill, Ph. D., M.D., Lafayette, 1858, *from the Author;* Rep. of Superin. of Education for Lower Canada for 1856, Toronto, 1857, *from Capt. L. A. Huguet-Latour.*

Nov. 15, 1858.

Dr. A. C. Koch in the chair.

Five members present.

The followings works were received: Jour. Franklin Inst., No. 5, Nov., 1858, *from the Society;* New Orleans Med. & Surg. Jour., Nov., 1858, *from the Editors.*

Dr. T. C. Hilgard presented several specimens of plants from the neighborhood of St. Louis, and a collection of Lichens and Algæ, in 25 folio volumes.

Nov. 29, 1858.

Vice President, Dr. A. WISLIZENUS, in the chair.

Twelve members present.

Letters were read from Dr. Wilh. Rud. Weitenweber, Sec. of the "Naturhistorische Verein Lotos in Prag," 3 July, 1858, transmitting publications; from the "Naturforschende Gesellschaft in Freiburg," 15 Oct., 1858, transmitting publications; and from Capt. L. A. Huguet-Latour, Montreal, 20 Nov., 1858, acknowledging receipt of No. 2 of the Transactions.

The following works were received: Lotos-Zeitschrift für Naturwissenschaften, Jahrgang VII., 1857, *from the Society;* Denkschrift über die Gebrüder Joh. Swat. und Carl Bor. Presl,—von Dr. W. Rud. Weitenweber, Prag, 1854,—Verzeichniss der K. Böm. Gesellschaft der Wissenschaften in Prag, 1855, *from Dr. Weitenweber;* Canadian Jour. of Industry, Sci. & Art., No. XVII., N. Ser., Sept., 1858, Toronto, *from the Canadian Institute;* Proc. of the Acad. Nat. Sciences, Phila., Sept., 1858, *from the Academy;* Proc. of the Bos. Soc. of Nat. Hist., Vol. VI., Oct., 1858, *from the Society.*

Dr. C. A. Pope presented, from the Rev. Mr. Higginbotham of Halifax, a walrus tooth, shark's tooth, horse-shoe crab, lobster, lower jaw of phocæna, star-fishes, &c., from Nova Scotia.

Dr. Pope read a letter from the Rev. Dr. S. Y. McMasters, of Palmyra, Mo., accompanying a coin found near Alton, Ill.

ST. PAUL'S COLLEGE,
Palmyra, Mo., Oct. 22, 1858.

My Dear Sir:—Having never been able to attend the meetings of the Academy of Science, I beg leave to present to it, through your kindness, the accompanying coin, with the translation of its inscriptions. It may never be of much value; but it is better in the keeping of a public institution than in private hands.

The coin was dug up in Alton, some five or six years ago, in digging a cellar. It was some five feet under ground, in hard *drift* clay, which would lead the superficial to think that it had been brought there in the drift. How it came there, or by whom brought, may be a question;—probably by some of the early French pioneers. Although the general formation in which it was found is drift, it must have had some modern disturbance, either by digging or washing;—or perhaps both. It was on high ground, some half mile from the city. The skeletons of bears, wolves, &c., have been commonly found in similar situations, doubtless covered by some local flood, perhaps even by one single rain. Or, some pioneer Jesuit may have buried it, purely as a record of early times, much as we deposit coins, &c., in the corner-stones of churches and other public buildings.

While in Washington, last summer, I showed it to Maj. Bowman, of the Engineer's Department; whereupon he, at once, called in Mr. Bruff, who was greatly given to the work of deciphering dark records in the oriental languages. His translation I send with the coin, to be kept, or disposed of, by the Academy.

Yours truly,
S. Y. McMasters.

Dr. C. A. Pope.

Description: — A modern copper coin of the Eng. E. India Company. Ob: Persian Arabic characters: "*He who is the shadow of Divine favor,*" &c. Rev: Two upper lines in Bengalese characters, Assamese language; middle line, rude Arabic (spoken by the Mahomedans of Assam). They signify the same thing, i. e., that the coin is of the current value of two pieces, in all the E. India dependencies of Great Britain.

J. Goldsborough Bruff.

Washington, July 10, 1858.

N. B. The Burmese conquered Assam, and treated the people with great severity until conquered themselves by the English, in 1824, and obliged by the peace of 1826 to leave the country, forever after, under the protection of the English East India Company. J. G. B.

A series of botanical specimens were presented by Dr. McPheeters.

December 13, 1858.

Dr. Geo. Engelmann in the chair.

Fifteen members present.

Letters were read from the Roy. Soc. of Sciences, Upsal, 8th Jan., 1858; the "Kön. Sächsische Gesellschaft der Wissenschaften," Leipzig, 6th Jan., 1858; the Bath and West of England Soc., Bath, Dec., 1857; Royal Soc. of London, 13th March, 1858; Linnean Soc. Lond., 8th Jan., 1858; the "Société Geographique Imp. de Russie," St. Petersburg, 18th December, 1857; Roy. Geog. Soc. London, 30th Dec., 1857; the "Naturforschende Verein zu Riga," 31st Jan., 1858; the "Naturhistorischer Verein der Preuss. Rhein. und Westphalens," Bonn, 11th Jan., 1858;—severally acknowledging the receipt of No. 1 of the Transactions.

The following works were received: Review of Marcou's Geol. of N. Amer., by James D. Dana, 1858, *from the Author;* Abhandl. der Senckenbergischen Naturforschenden Gesellschaft, I. Band. 2 Lief., 1855, and II. Band. 1 Lief. 1856, Frankfurt a. M., *from the Society.*

Mr. Conrad Witter presented four boxes of prepared imitations of various poisonous and edible mushroons.

Dr. Engelmann exhibited examples of impressions of botanical specimens, taken by the process invented and now in use in Vienna, called "*Natur selbstdruck*." A minutely accurate impression of the *dried* specimen on a sheet of very soft lead is obtained by passing both between steel cylinders; copperplates, fit for printing, are then obtained in the usual way by electrotyping. He considered it admirably adapted for the purpose of exhibiting the accurate form and the more delicate venation of leaves, though the stems and thicker parts of plants could not be copied in this manner.

Dr. Hilgard continued his remarks on the relation óf the parts of the skull to the vertebræ, illustrating the subject from the skulls of fishes, and especially the Buffalo-fish (*Catostomus*), which he considered as well adapted to exhibit the parts in question.

Mr. J. H. Gardner was elected an associate member.

December 27, 1858.

Vice-President Dr. A. Wislizenus in the chair.

Ten members present.

Letters were read from the "Gesellschaft für Beförderung der Naturwissenschaften zu Freiburg i. B.," 25th Jan., 1858; the "Overijsselsche Vereeniging tot Ontwikkeling van Prov. Welvaart," Zwolle, 13th March, 1858,—the "Verein für Vaterländische Naturkunde in Württemberg," Stuttgard, 31st May, 1858,—Royal Soc. of Sciences, Göttingen, 27th May, 1858,—the "Oberhessische Gesellschaft für Natur-und-Heilkunde," Giessen, April 6th, 1858,—the "Naturforschende Gesellschaft in Danzig," 8th April, 1858,—the "Bibliothéque de L'Université de Gand," 20th May, 1858,—severally acknowledging the receipt of No. 1 of Vol. I. of the Transactions, and transmitting publications in exchange.

The following publications were received: Zeitschrift für die Gesammten Naturwissenschaften von dem Nat. Verein für Sachsen u. Thüringen in Halle, Jahrg. 1856 & 1857,—*from the Society;* Berichte über die Verhandl. der Gesellschaft für Beförderung der Naturwissenschaften zu Freiburg i. B., Heft I.—IV. (25—29) 1855-1858, *from the Society;* Redoevering over Het Voorlbrengend Vermogen der Prov. Overijssel, door

Mr. J. A. Van Roijen, Zwolle, 1842,—Voorlezing, bevattende eenige beschenwingen Betrekkelijk den Physicken Toestand de Lage Bodems, door. B. P. G. van Diggelen, Zwolle, 1843, —Verhand. over de Verbetering van het Zwolsche Diep, door B. P. G. van Diggelen, Zwolle,—De Aardkunde van Twenthe, eene voorlezing door Dr. W. C. H. Staring, Salland, en het Land van Vollenhove, door Dr. W. C. H. Staring,—Overzigt der Landbouw-Scheikunde door Nederlanders, Zwolle, 1846,—Verhand. over den Overijsselschen Vee-Stapel, door J. Jennes, Zwolle, 1849,—Onze Banken van Leening door Mr. J. Kalff, Zwolle, 1849,—Catalogus van het Museum, 1852,—Ontwerpen voor eene Vaste Brug over den Ijssel, 1856,—Catalogus van de Bœkerij der Overijs. Vereen. tot Ontwikkeling van Prov. Welvaart te Zwolle, 1857,—Algemeen Jaarlijksch Verslag van der Directie der Overijs. Vereen. tot Ontwikk. van Prov. Welvaart, 1854–6–7, 3 Vols,—*from the Society;* Mémoires de L'Académie Imp. des Sciences, Arts et Belles-Lettres de Caen, 1858, *from the Society;* Württembergische Naturwiss. Jahreshefte, XIV. Jahrg. 2 & 3 heft, Stuttgart, 1858, *from the Society;* Nachrichten von der Georg-Augusts Univ. und der Königl. Gesellschaft der Wissen. zu Göttingen, 1857, *from the Society;* Berichte der Oberhessichen Gesellschaft für Natur-und Heilkunde, V.—VII. (2 Hefte), 1855–7, Giessen,—über die Naturwissenschaften von Dr. Philipp Phœbus, Nordh., 1849, *from the Society;* Recherches sur l 'Anatomie, la Physiologie et l'Embryogénie des Bryozoaires, par P. J. Van Beneden, Brux., 4to, 1840,—Recherches sur les Bryozoaires fluviat. de Belgique, par P. J. Van Beneden, Brux., 4to, 1857,—Recherches sur L'Embryogénie des Tubulaires, par P. J. Van Beneden, *from the Author;* Neuste Schriften der Naturfors. Gesellschaft in Danzig, Vol. IV. Heft 1—4, Vol. V. Heft 1—4, Vol. VI., Heft 1, 1843–1858, *from the Society;* Annales des Universités de Belgique, 1853–4–5, Brux., 1859, *from the University;* Hints to Craniographers, by J. Aitken Meigs, M.D., Phil., 1858, *from the Author;* Proc. of the Amer. Antiq. Soc., Worcester, 1858, *from the Society;* Amer. Geol.—Letter on Geol. of Texas, N. Mexico, Kansas and Nebraska, to Messrs. Meek & Hayden, by Jules Marcou, Zurich, 1858,—Geological Map of N. Mexico, by Jules Marcou, 1857,—Carte des Etats-Unis de L'Amérique-Nord, par W. Maclure (fac simile), Zurich, 1858,—Notes for persons who collect Shells, by A. E. Belknap, Boston, 1850,—*from Prof. Jules Marcou;* Jour. of the Franklin Inst., No. 6, Dec., 1858, *from the Society.*

Dr. Wislizenus presented to the Academy, on behalf of Mr. Conrad Witter, a sandstone slab from the Triassic formation near Hildburghausen in Germany, containing foot-prints of a reptilian animal allied to the Cheirotherium.

Dr. Engelmann exhibited specimens and drawings of the "Buffalo-grass" of our western Prairies. It had been described, some forty years ago, by Mr. Th. Nuttall under the name of *Sesleria dactyloides*, but neither he, nor any of the numerous subsequent explorers, had discovered pistillate flowers. Among a botanical collection made by his brother, Henry Engelmann, who went as Geologist with the Utah Expedition, he found among the male also female specimens. They are on different stalks, so that the plant is one of the few truly diœcious grasses known. The female plant is very different from the male, so that they might have been taken for different species. There is another diœcious grass found in the U. States on the coast of Texas,—as far as known, as yet undescribed.

January 10, 1859.

Vice-President Dr. A. Wislizenus in the chair.

Nineteen members present.

A letter was read from Prof. Jules Marcou, Zurich, 5th Dec., 1858, acknowledging the receipt of Nos. 1 & 2 of the Transactions, and transmitting publications; also, a letter from the Hon. F. P. Blair, jr., U. S. House of Reps., 5th Jan., 1859, transmitting public documents.

The following works were received: Smithsonian Rep. for 1857, 8vo., Wash., *from the Institution;* Canadian Jour. of Ind. Sci. & Art, No. XVIII., Nov., 1858, *from the Canadian Institute;* Catalogue of N. Amer. Birds, by Spencer F. Baird, Asst. Sec. of the Smith'n Institution, Phil., 1858, *from the Author;* Hints to Craniographers, by J. Aitken Meigs, M.D., *from the Author;* Smithsonian Rep. for 1857,—Congressional Globe, 1st Sess. of the 35th Cong., and Special Sess. of the Senate, by John C. Rives, Vol. XXXVI., Part I. Wash., 4to., 1858,—U. S. Naval Astron. Exped. to Chili, by Lieut. J. M. Gilliss, L.L.D., Vol. III., 4to., Wash., 1856,—*from the Hon. F. P. Blair, jr.;* Balliére's bi-monthly List; the Mosaic Account of the Creation, by J. C. Fisher, M.D., 1858, *from the Author;* Proc. of the Acad. of Nat. Sci., Phila., Nov. 1858, *from the Society;* Proc. of the Amer. Pharmaceutical Asso., 1858, *from Eugene L. Massot.*

Dr. Engelmann donated a photographic plate of the remains of the temple of Jupiter Serapis at Pozzuoli, and explained the geological importance of these antiquities.

Dr. Wislizenus read an extract from a communication addressed to him by Mr. Wm. McAdams, jr., giving an account of certain ancient mounds lately discovered by him in Jersey county, Ill.

The Corresponding Secretary was directed to send copies of Nos. 1 & 2 of the Transactions of the Academy to Mr. McAdams, and request him to draw up a full description of the mounds in question for publication.

The Corresponding Secretary communicated the following extract from a letter addressed to him by Prof. Jules Marcou:

[TRANSLATION.]

Dear Sir: * * * * * My endeavors at Geological Maps are very crude and very imperfect, and I earnestly desire that the learned Geologists of the West may make them more correct, and give them the form which may approximate them more nearly to the truth. In publishing them, I have endeavored to give the general outlines and rational ideas upon the new regions of the West. I do not at all fear the criticisms which have been made, and still are made, in almost every number of Silliman's Journal, upon my observations and opinions. In ten years from this time, we shall know very well who has been wrong, I, or my adversaries. Here are the divergences of opinion, which I undertake to establish, and which I pray you to communicate to your Academy:

I. The red sandstones of Lake Superior are of the epoch of the New Red Sandstone, and, more particularly, of the stage of the Bunte Sandstein: whilst Hall, Henry Rogers, Logan, Whitney, and Foster, refer them to the Potsdam Sandstone.

II. The carboniferous limestones of the Rocky Mountains, and generally of Pécos village, Vigeras, and the Sandia Mountains, New Mexico, belong to the Lower Carboniferous; I have seen them below the true Coal Measures: whilst Hall, in his geological chart in Emory's Report, says that they are of the Upper Carboniferous above the Coal Measures.

III. The New Red Sandstone with its four stages—that is to say, Permian, Bunter Sandstein, Muschelkalk, and Keuper—exists on both sides of the Rocky Mountains, and covers an extent of country more considerable than any other formation in the United States: whilst Hall, Dana, Rogers, and others, place all this New Red in the Cretaceous formation.

IV. The Jurassic exists all around the Rocky Mountains: whilst Hall, Rogers, Geo. Shumard, and others, make it of the Cretaceous formation.

Of divergences of opinion upon less general questions, I do not speak; these are the chief. * * * * Yours truly,

Zurich, 5 Dec., 1858. JULES MARCOU.

Dr. Wislizenus read a paper containing a report of his Meteorological Observations, at St. Louis, for the year 1858. The paper was ordered for publication in the Transactions.

The Acting President, Dr. Wislizenus, read the following report upon the progress of the Academy during the past year:

ANNUAL REPORT.

In the absence of our President, Dr. B. F. Shumard, who, having been appointed State Geologist of Texas, has found there a more extensive field for his scientific acquirements, the duty has devolved upon me of laying before the Academy an abstract of our progress during the last year. I am happy to state that our young Institution has given also, in the past year, such proofs of its activity, that its future permanency may be safely relied upon. Our meetings have been regularly attended, and were enlivened by scientific discussions, and by verbal and written communications on a great variety of subjects; donations to our Museum and Library have been most liberally forwarded from friends far and near; and the second number of our "Transactions," published during the last year, has been received with great favor, if not partiality, by the scientific world, both at home and abroad.

The distribution of our publications in foreign countries has been chiefly effected through the agency of the Smithsonian Institution, and in this way we have been put in communication with numerous Institutions of similar tendency in the cultivated world, who kindly appreciate the first fruits of our industry, and in exchange return us most valuable books and whole sets of scientific journals. The number of societies to which our Transactions have been sent is one hundred and eighty-one, to wit:

Forty-nine within the United States, Canada, Mexico, Cuba, and Chili; 5 in Asia; 2 in Australia; 1 in Africa; 134 in Europe—1 Ireland, 1 Denmark, 2 Norway, 4 Sweden, 1 Spain, 1 Portugal, 6 Switzerland, 6 Belgium, 7 Holland, 8 Russia, 12 Italy, 22 France, 24 Great Britain, 39 Germany; and from a large number of them returns have been received.

It is certainly very desirable to keep up this intercourse with our newly acquired scientific friends, and the yearly publication on our part of a volume, large or small as our means allow, seems to be the most appropriate mode of doing it.

The acquisitions that our Library has made during the past year are quite considerable. Most of them we owe to the liberal system of exchange from older societies, but a great many also to private donation. The public documents, too, of the last Congress, presented to us by the Hon. Trusten Polk and the Hon. Frank P. Blair, afford an unusual interest on account of the numerous Pacific Railroad explorations, with contributions from a host of scientific men.

The additions made to the Museum emanate nearly all from the liberality of gentlemen who justly think that objects of that class are made more useful under the control of a society, that classifies and arranges them, than in private hands. I will mention some of them under their different departments:

Ethnology.—The Rev. C. H. A. Dall, of Calcutta, India, presented us with an interesting collection of East Indian figures, exhibiting the characteristics of that Eastern people.

Comparative Anatomy.—Drs. Pope and Hilgard made some valuable additions to this class.

Mammalogy.—Col. A. J. Vaughan has enriched this department with a handsome specimen of the Grizzly Bear.

Ornithology has received additions from Capt. John Pope, collected by him (on the 32d parallel) and by E. Weyden, Esq.

Herpetology and Ichthyology.—Specimens of *Siren lacertina*, caught after the great flood in the American Bottom, were donated by Dr. Sander and Mr. De Clausel.

Malacology.—Prof. A. Winchell, of Michigan, increased this department by a collection of land shells.

Botany.—Dr. Th. C. Hilgard presented to the Academy a collection of the flora of this neighborhood; also a collection of lichens and algæ. Through the kindness of C. Witter, Esq., we received from Germany a fine collection of artificially made mushrooms.

Meteorology.—Drs. Engelmann and Wislizenus reported an abstract of their complete Meteorological Observations for the last year.

Mineralogy.—This department received many interesting specimens from Dr. Pope, Messrs. Cozzens, Harrison, De Baun, Jones & Colman, and

Bender. The latter gentleman presented also a set of mathematical figures for the illustration of Crystalegraphy. Chas. P. Chouteau, Esq., has enriched this department with an exquisite specimen of meteorite, from the neighborhood of Fort Pierre, weighing 85 pounds.

Palæontology and Geology.—Although we have acquired no collection in this department, as in previous years, many valuable donations have nevertheless been made by Messrs. J. Charless, E. Pratt, Drs. Pope, Kennard, Koch, and others. Dr. B. F. Shumard, before his departure, deposited with the Academy three hundred specimens of Tertiary fossils, from Austria; Trilobites from the Lower Silurian of Bohemia, and fossils from the Trias of the Alps. Through the favor of our associate member, C. Witter, Esq., we received also in exchange from Hildburghausen, Germany, a superb specimen of the celebrated *Cheirosaurus* or *Cheirotherium*, which, when first discovered in 1833, by Mr. Sickler, in the New Red Sandstone of that region, created a great sensation among geologists. The slab, upon which three larger and three smaller tracks of that singular quadruped are well preserved, measures nearly five feet in length, and a foot and a half in width, and would be an ornament to any collection.

In connection with this department, I have yet to mention the interesting discovery, within the past year, of the Permian System in the Territory of Kansas, and its probable extension over a great part of the West. The minutes of the Academy show us what part was taken by several members of our society in this discovery. In February of last year, Professor Swallow and Dr. Shumard informed the Academy of the discovery of certain fossils made in Kansas by our corresponding member, Major F. Hawn, of the U. S. Survey, which led the first named gentleman to the opinion that the Permian System existed in that region. In March, Dr. Shumard informed the Academy that from a series of fossils collected by his brother, Dr. George G. Shumard, in the Guadalupe Mountains, New Mexico, he had also discovered the Permian System in that region. Dr. J. G. Norwood, of Illinois, wrote to the Academy, in April, that he believed he had found the same system in the upper beds of the La Salle Coal field, in Illinois. Prof. Swallow and Dr. Shumard prepared soon afterwards a paper on the subject, which created at first some discussion among geologists; but the discovery of new and more characteristic fossils seems to have removed all doubts, and the existence of the Permian System in Kansas may be regarded as a fact. Near the same time, Mr. F. B. Meek and Dr. F. V. Hayden, at Philadelphia and Albany, published, also, an account of this discovery, claiming the priority for themselves,—a question which we are unable to decide; nor do we consider it of great importance, since all of them, no doubt, deserve credit for their zeal in proving a new geological system in the West.

I consider it needless to enumerate here all the scientific papers read before the Society during the last year, since nearly all of them have been published in the second number of our Transactions, and have thus become public property. Upon the authority of Dr. Engelmann, I will mention that, in Europe, the geological and palæontological papers published therein by Prof. Swallow, Drs. Prout, B. F. and George Shumard, and Major Hawn, were received with especial favor.

Lastly, I have to state, from the report of the Treasurer, Dr. Pollak, that the receipts of the Academy, for 1858, were $1,258,—the expenditures $1,216; and that, after meeting our liabilities, he estimates an actual balance of about $200 in our favor, in dues from members. The number of our corresponding members is at present 82; the exact number of associate members I could not ascertain, since many of them have indirectly withdrawn by not paying their dues. The dues from associate members form at present our only revenue, and it requires strict economy to pursue, with such limited means, the various objects of our Society. Similar institutions in Eastern cities have had, in the beginning of their career, to undergo similar trials of mind versus matter; but liberal-minded citizens lent them a helping hand, and endowed them with sufficient means to make their field of operation more extensive and useful. The Academy of Natural Sciences in Philadelphia, for instance, holding now the first rank, would not have prospered as well without the munificent generosity of a Maclure and others. Our own city, the great centre of the Mississippi Valley, can certainly boast of as wealthy and liberal men as any in the Union. Let us hope that, in a not far distant day, a Maclure may arise among them, willing to perpetuate his name in the annals of Science.

The Corresponding Secretary presented his report of correspondence for the past year, which was accepted.

The Treasurer presented his annual report for the year 1858, which was referred to an Auditing Committee, consisting of Messrs. Eads, Smith and Harrison, and, on examination, being found correct, was accepted.

The following gentlemen were elected officers of the Academy for the year 1859:

President,	Adolphus Wislizenus.
1st Vice President,	George Engelmann.
2d Vice President,	Charles A. Pope.
Corresponding Secretary,	Nathaniel Holmes.
Recording Secretary,	J. S. B. Alleyne.
Treasurer,	S. Pollak.
Librarian,	Theodore C. Hilgard.
Curators,	H. A. Prout, C. W. Stevens, T. C. Hilgard, and Spencer Smith.
Com. on Publication,	N. Holmes, Wm. M. McPheeters, George Engelmann.
Com. on Library,	H. A. Prout, C. A. Pope, Samuel Reber.
Committee on Finance,	Spencer Smith, J. B. Eads, C. C. Whittelsey.

Chairmen of the Standing Committees, for the year 1859, were appointed by the President as follows, viz:

Ethnology,	N. Holmes.
Comp. Anatomy,	C. A. Pope.
Embryology,	J. S. B. Alleyne.
Mammalogy,	C. W. Stevens.
Ornithology,	M. Lewis Clark.
Herpetology and Ichthyology,	M. M. Pallen.
Entomology,	Wm. M. McPheeters.
Botany,	Geo. Engelmann.
Palæontology and Geology,	H. A. Prout.
Mineralogy,	A. C. Koch.
Chemistry,	A. Litton.
Physics,	Spencer Smith.
Astronomy,	G. Seyffarth.
Meteorology,	G. Engelmann.

January 24, 1859.

The President, Dr. A. WISLIZENUS, in the chair.

Eight members present.

A letter was read from Lieut. G. K. Warren, U. S. Top. Engrs., transmitting twenty-five copies of Map of the U. S. Territories between the Mississippi River and the Pacific Ocean; and also, a letter from Edward L. Young, Norfolk, Va., requesting a copy of No. 1 of the Transactions, which was ordered to be sent to him.

The following books were laid upon the table: Nat. Hist. of the Amphiumidæ, with remarks, &c., by Bennet Dowler, M.D., *from the Author;* Cong. Globe, Vol. XXXVI., Parts II. & III., Wash., 4to., 1857–8,—Vol. XXXVII. Appendix, 1857–8, Wash., 4to., 1858,—*from the Hon. F. P. Blair, jr.;* N. Orleans Med. & Sur. Jour., Vol. XVI., No. 1, Jan., 1859, *from the Editors;* Smithn. Rep., 1857, *from the Hon. T. Polk;* Jour. Franklin Inst., Vol. XXXVII., No. 1, January, 1859, *from the Institute.*

Dr. Engelmann presented a specimen of the black variety of the Missouri Fox Squirrel. This variety occurs occasionally in this vicinity, and some specimens can be obtained in our markets almost every winter. It has been described by Bachman under the name of *Sciurus Auduboni*, but can not be separated from the common western fox squirrel, which had all along been known as *Sciurus macrourus*, Say, or, as this name had been preoccupied, as *Sc. Sayi*, Aud. & Bachm. Prof. Baird, however, has shown that it had been described, long before Say, by Custis, as *Sciurus Ludovicianus*, and has restored this name to our species; our present specimen would properly bear the designation, *varietas atroventris.*

Mr. Joseph Charless presented several specimens of minerals.

Mr. S. Smith exhibited an apparatus contrived to illustrate, by the use of an artificial globe, the experiment of Foucault, demonstrating the revolution of the earth on its axis.

Dr. Wislizenus made some observations on the means of testing the presence of ozone in the atmosphere. He had been unsuccessful, hitherto, in numerous and varied experiments, in obtaining any indications of ozone at this locality, by the method adopted by Prof. Schoenbein, using slips of starched paper impregnated with a solution of iodide of potassium, which is turned blue by ozone.

February 7, 1859.

The President, Dr. A. Wislizenus, in the chair.

Thirteen members present.

Letters were read from the Secretary of the Smith. Inst., accompanying packages transmitted; and from the "K. Danske Videnskabernes Selskab," 1st July, 1858,—the "Zoologisch-botanische Verein," Vien., 15th March, 1858,—the "Siebenbürgischer Verein für Naturw.," 5th March, 1858, the "K. K. Geol. Reichsanstalt," Vienna, 10th Jan., 1858,—the "I. R. Istituto Veneto di Sci., Lettere ed Arti," Venice, 15 Dec., 1857,—"Presidenza di I. R. Accademia di Sci., Lettere ed Arti di Padova," 1 Dec., 1857,—the "I. R. Accad. di Sci., Lettere ed Arti di Padova," 16 Dec., 1857,—the "Museum Francisco-Car.," Linz, 28 Dec., 1857,—the "Werner-Verein zur Geol. Durchforschung von Mähren und Schlesien," 14 Dec., 1857,—severally acknowledging the receipt of No. 1, Trans., and transmitting publications in exchange; also, a letter from Wm. McAdams, Jr., Jerseyville, Ill., 24 Jan. 1859, concerning his discoveries among the mounds in Jersey county.

The following works were received: Patent Off. Rep. for 1857, Mechanics, 3 Vols., 8vo., Wash., 1858,—*from the Hon. F. P. Blair, Jr.;* 25 copies of Map of the Territories of the U. S. between the Mississippi River and the Pacific Ocean, by Lieut. G. K. Warren, Top. Eng. U. S. A,—*from Lieut. G. K. Warren;* Atti del' I. R. Istituto Lombardo de Scienze, Lettere ed Arti, Vol. I., Fasc. 1—5, Milano, 4to, 1858,—*from the Society;* Verhandlungen der Naturforschenden Gesellschaft in Basel, II. Theil, 1 Heft, 8vo., Basel, 1858,—*from the Society;* Oversigt over det Kongelige danske Videnskabernes Selskabs Forhandlinger og dets Medlemmers Arbeiten, 1 Aarot, 1857, & Questiones, 1858,—*from the Society;* Verhandlungen des Zoologisch-botanischen Vereins in Wien, Band VII., 1857, Wien,—*from the Society;* Verhandlungen und Mittheilungen des Siebenbürgischen Vereins für Naturwissenschaften zu Hermannstadt, Jahrgang, I.—VII.,—Fauna der Wirbelthiere Siebenbürgens, &c., von E. Albert Bielz, 1856,—Statuten des Siebenbürgischen Vereins für Naturw. zu Hermannstadt, 2 cop., 1855,—*from the Society;* Jahrbuch der K. K. Geologischen Reichsanstalt, VIII. Jahr., No. 4, Oct., Nov. & Dec., 1857, Wien,—*from the Society;* Atti dell' I. R. Istituto Veneto de Scienze, Lettere ed Arti, 1856 & 1857, Tom. II., Ser. III., Disp. 1—10; Tom. III., Disp. 1 & 2, Venezia, 1857-8,—*from the Society;* Rivista Periodica dei Lavori della I. R. Accademia di Scienze, Lettere ed Arti in Padova, Vol. V., Trim. 3 & 4, 1857, Fasc. XII.—*from the Society;* Verhandlungen des Vereins für Naturkunde zu Presburg. I. Jahr., 1856; II. Jahrg., 1 Heft, 1857,—*from the Society;* Siebenzehnter Bericht über das Museum Francisco-Carolinum, Linz., 1857,—Beiträge zur Palæontologie und Geognosie von Oberösterreich und Salzburg, von Carl Ehrlich, M. Ph. &c., Linz., 1855,—Geognostische Wanderungen in Gebiete der nordöstlichen Alpen von Carl Ehrlich,—*from the Museum F. C.;* Jahresbericht der Direction des Werner-Vereins zur Geologischen Durchforschung von Mähren und Schlesien, I.—VI., 1851—1856, Brünn,—Beiträge, zur Kenntniss der geognostischen Verhältnisse des mährischen Gesenkes in den Sudeten, von Albin Heinrich, 1854,—Bericht über einige im Zwittawa-Thale und im südwestlichen Mähren ausgeführte Höhenmessungen, von Prof. Karl Koristka,—Beiträge zur geognostischen Kenntniss Mährens, von Dr. Aug. Emm. Reuss, Prof. zu Prag., 1854,—*from the Society;* Verhandelingen der Koninklijke Akad. van Wetenschappen, I.—VI. Deel, 4to, 1854—1858, Amsterdam,—Verslagen en Mededeelingen der K. Akad. van Wetenschappen, Afdeeling Natuurkunde, I.—VI., 8vo;—Setterkunde, I.—III., 8vo,.—Jaarbœk van de K. Akad. van Wetens. 1 Deel, 1 Stuck, Amsterdam, 1857,—Lycidas Ecloga et Musæ Invocatio;—Octaviæ Querela, Amsterdam, 1857,—*from the Roy. Soc. of Sciences.*

Mr. Chas. P. Chouteau presented a fine mounted specimen of the Cross Fox, from the Upper Missouri River.

February 21, 1859.

The President, Dr. A. WISLIZENUS, in the chair.

Eleven members present.

The following publications were received: Zeitschrift der Deutschen Geol. Gesells. Band. IX., Heft 4, Band. X. Heft 1, Berlin, 1857-8,—*from the Society;* Geol. Rep. on the S. W. Branch of the Pacific Railroad, by G. C. Swallow, State Geologist, 1858,—*from B. A. Hill, Esq.;* Canadian Jour. of Ind., Sci. & Art, for Jan., 1859,—*from the Canad. Institute.*

Dr. Engelmann presented a living specimen of a Menobranchus found in this vicinity.

A paper on the "Filtration of Water," illustrated by a diagram, by Mr. Reineke, was read by Dr. T. C. Hilgard, and referred to a committee.

Dr. Koch communicated the substance of a letter addressed to him by Mr. J. V. Phillips, giving a description of a Totemic mound, situated about nine miles from Dubuque, in the State of Iowa.

Dr. Engelmann stated that, on the 19th & 20th Feb. last, the Thermometer at this point had passed through 46° F. in 12 hours, falling from 76° in the afternoon to 30° on the following morning. Such violent changes were not usual in our climate, occurring only once every five or six years, but in two instances he had noticed a still more violent fall of temperature, 52 to 54°, in as short a time.

Mr. Wm. McAdams, Jr., of Jerseyville, Ill., was elected a correspondent.

Samuel Annan, M.D., and O. Blank, M.D., were elected associate members.

March 7, 1859.

The President, Dr. A. Wislizenus, in the chair.

Eleven members present.

The following works were received: Rep. on Finances, 1858,—Patent Off. Rep. for 1857,—Explor. & Sur. of Pacific R. Routes, Vol. IX., Zoology, Part II., Birds of N. Amer., Wash., 4to, 1858,—Rep. on Comm. & Nav. 1858,—*from the Hon. F. P. Blair, Jr.;* Jour. of the Franklin Inst., No. 2, Feb. 1859,—*from the Institute;* Cat. of the Univ. of Mich., for 1859.

Dr. Engelmann presented a fossil bone, found by him some fifteen years since on the bank of the Mississippi, being a portion of the *os petrosum* and orbit of an ox different from the common ox and the buffalo, and probably belonging to Leidy's *Bos cavifrons.*

Dr. E. also exhibited a branch and flowers of the *Ulmus Americana*, found in this vicinity. It was the same as that found in the eastern States, though it did not attain such majestic dimensions and graceful form as there; in our bottom woods, however, immense trees of it may be seen. He spoke about the biserial phyllotactic arrangement of the leaves and branches being, together with the slenderness of the branches and twigs, the cause of the peculiarly graceful growth of this tree.

A paper on "Pavements," and a paper on the "Poplar Street Sewer," by Mr. Reineke, was read by Dr. Hilgard, and referred to a committee.

George Johnson, M.D., and Messrs. J. V. Phillips, Augustus McDowell, and Charles H. Vanderford, were elected associate members.

March 21, 1859.

Vice-President Dr. Geo. Engelmann in the chair.

Eight members present.

A letter was read from the Sec. of the Smith. Institution, 4 March, 1859, transmitting publications; and also, a letter from the Lyceum of Nat. Hist., N. Y., acknowledging the receipt of No. 2 of the Transactions.

The following publications were laid upon the table: Proc. of the Acad. Nat. Sci., Phil., Jan., 1859,—*from the Society;* Geol. Rep. on S.W. Br. of Pacif. R.,—*from Col. C. Kribben;* Proc. of the Amer. Antiq. Soc., Worcester, 1859, *from the Society;* Proc. of the Bos. Soc. of Nat. Hist., Jan. & Feb., 1859,—*from the Society;* N. Orleans Med. & Sur. Jour., No. 2, March, 1859,—*from the Editors;* Jour. of the Franklin Inst., Phil., March, 1859,—*from the Society.*

Prof. G. Seyffarth read a paper entitled "An Astronomical Inscription concerning the year 1722 B. C.," illustrated by a fac simile of the inscription. The paper was ordered for publication in the Transactions.

Prof. W. P. Riddell, of Austin, Texas, was elected a correspondent, and Dr. Pösche was elected an associate member.

April 4, 1859.

The President, Dr. A. Wislizenus, in the chair.

Eighteen members present.

A letter was read from the Pottsville Sci. Asso., 21 March, 1859, transmitting publications and requesting those of the Academy in exchange: also, a letter from the Smith. Inst., 18th March, 1859, advising of the transmission of publications; also, a letter from Mr. Conrad Witter, 2 April, 1859, with a list of botanical specimens presented; and a letter from Dr. O. W. True, 1 April, '59, concerning an exchange of publications.

The following works were received: Smith'n Contr. to Knowl., Vols. I.—VIII. & X. *from the Institution;* Proc. of the Acad. of Nat. Sci., Phil., Feb., 1859,—*from the Society;* Rep. of Explor. & Sur. of Pacific R. Routes, Vol. IX., Wash., 4to,—*from the Hon. Trusten Polk;* Fossil Plants of the Coal Meas. of the U. S., by Leo. Lesquereux, Pottsville, 1858,—

from the Pottsville Sci. Asso.; Proc. of the Amer. Phil. Soc., Phil., No. 60, July & Dec., 1858,—*from the Society.*

Dr. Pope read a communication from Mr. J. B. M. Southerton, presenting Indian pottery, a stone chisel, and other Indian implements, found in Missouri; and, also, a honeycomb-like piece of wood of an old oak tree, being probably the result of fungous development throughout the inner wood of the trunk.

Prof. Seyffarth presented an impression in wax of the seal ring of Pharaoh Suphis (builder of the great pyramid of Cheops,) taken from the ring now in Dr. Abbot's Museum, in New York. He remarked that he had seen the ring itself, and considered it as belonging to the XIXth Dyn., in the time of David, and not to the IVth Dyn., as had been supposed by some authors.

Dr. Engelmann presented a specimen of Tapeworm (*Tænia solium*). He observed that he had never seen any in natives of Missouri; all those observed by him were found in immigrants from Europe, and also in some Texans after a long captivity in Mexico. He dwelt upon the late discoveries of the compound nature of the Tapeworm and its earlier stages of development as the "measles" of the hog.

The Corresponding Secretary read a paper by Edward Miller, Civ. Engr., entitled "A Memoir on Methods of obtaining Water on the High Prairies of Missouri." The paper was referred to a committee.

Mr. J. C. Reid presented a specimen of fossil coral from the bluffs in Illinois, near the track of the O. & Miss. Railroad.

April 18, 1859.

The President, Dr. A. Wislizenus, in the chair.

Ten members present.

A letter was read from Dr. B. F. Shumard, Austin, Texas, 3 April, 1859, enclosing a paper and drawings of fossils for publication; also, a letter from the Essex Institute, 2 April, 1859, and a letter from Prof. S. F. Baird, Asst. Sec. of the Smith'n Inst., March 19, 1859.

The following publications were received: Proc. of the Essex Inst., Vol. I., 1848—1856,—*from the Society;* Circular on the Elevation of certain Districts of Penn. above Tide Water, by P. W. Sheafer,—*from the Pottsville Sci. Asso.;* Bibliotheque de feu M. Lichtenstein,—*from the Publisher;* Sur le Néocomien dans le Jura et son role dans la Série stratigraphique, par Jules Marcou, Genève, 1858,—*from the Author*; Mém. et Doc. relatives à L'Histoire du Canada, publiées par la Soc. Historique de Montreal, 1859,—*from the Society*; Jour. of the Frank. Inst., Phil., No. 4, April, 1859,—*from the Society*.

The Corresponding Secretary read a paper by Dr. B. F. Shumard, accompanied with drawings of Permian fossils, entitled "Notice of New Fossils from the Coal Measures and Permian strata of Texas, obtained by the U. S. Expedition under Capt. John Pope for boring Artesian Wells along the 32d parallel." The paper was referred to a committee.

Mr. S. Smith read a paper by Prof. John Russell, of Bluffdale, Ill., on "Western Antiquities." The paper was referred to a committee.

Dr. Pollak said he was authorized by Mr. C. P. Chouteau to state, that he desired the Academy to name some Naturralist to accompany him on his expedition to the Upper Missouri, this summer, and free of expense to the Society. Dr. Marsh was appointed to that service, and the thanks of the Academy were voted to Mr. Chouteau for his generous offer.

Dr. Wislizenus presented a large black spider, a species of *Mygale*, which had been found in the streets of the city.

Dr. Hilgard presented from his brother, Prof. E. W. Hilgard, State Geologist of Mississippi, a collection of 307 species of plants from that State. The thanks of the Academy were voted to Prof. Hilgard.

Dr. Hilgard produced a number of skulls, such as those of the new-born infant, young cat, muskrat, rat, chicken, swan, turtle, frog, that of the catfish (Pimelodus), muskalonge (Esox estor, Les.), white perch (Corvina oscula, Les.), and a number of skulls of buffalo-fishes (Bubalichthys, Ag.), variously disjointed for schematic illustration, for the purpose of demonstratiug these considerations of comparative anatomy:

1. The fabric of the cranium involves *five* (not only, as is now prevalently considered, four) complete vertebral belts, each consisting only of the typical parts and that in the typical numbers, namely: one body, two bi-capitular (perforated) side-slabs (processus transversi), and two apical ones.

2. The theory of Oken and Cuvier being demonstrably correct, "that the temporal bones are inserted into crevices of the skull," these once truly identified, and eliminated from the rest of the cranium, the parts left under consideration conform to the above numeric rules.

3. The pars squamosa of the human occipital bone, with the lineæ semicirculares outside and the eminentia cruciata inside, is representative, and composed of two pairs of top-slabs.

In fishes, the first vertebra, commencing at the spine, is represented by the first basal element; its superincumbent pair of plates; and, severed from it by an intervening temporal "processus mastoideus:" the two lower quarters of the rhombic, cruciate-crested "diamond" or Owen's "keystone."

This first ring is visibly represented, e. g. in the new-born infant, by the first half of the Clivus Blumenbachii, and that is impressed for the medulla oblongata (incl. of corpora olivaria) imbedded on it, as a block; with the flat condyloid slabs, each perforated (between its prongs) by the (motor) hypoglossic nerve; and that piece of the occipital "squama" which is below the linea semicircularis, or the transverse arms of the eminentia cruciata internally, and that in the ancient Peruvian skulls described by Tschudi, is demarcated by an actual suture both in adults and infants. This suture is the same which in such mammals as the cat, muskrat, rat, etc., is preserved, close beyond the insertion of muscles or the steep part of the occiput.

The remaining triangular, "crescent," or otherwise tabulate bone—that part which, in man, is contained between the cross-arm of the eminentia cruciata and the sutura lambdoidea, are the fused top-plates of the second, or auditory, vertebra. All median bones, except the blocks, of the vertebral fabric existing typically *by pairs*, and median fusions frequently occurring all along the spine and in the tabulate top-slabs, e. g. of the frontal bone likewise, (adult man, codfish, etc.) there can be no objection to the same supposition in this case, as well as in that of the (fused) platform of the fifth or olfactory vertebra, too.

The next three transverse processes, or side-slabs, and respectively containing the Pons Varolii, Hypophysis cerebri (sella turcica), and Chiasma opticum, severally pass these specific nerves,—the acoustic, the glossopharyngeal, and the optic,—and they are indicative of as many vertebral belts. Although underlaid, in many fishes, by a single lithe slab, in lieu of a corresponding number of block-pieces, yet, on closer inspection, it significantly presents three *sellar intractions*, each indicative of one presumable block-piece,—all those of the fish-spine generally being rather hour-glass shaped, or "thin-waisted." In the infant skull, as in mammals, the block containing the actual *sella turcica* is completely separated from the adjacent optical and basilar ones; hence, the several sections being identifiable by their corresponding contents no less than by their rigid confines, we find each one occasionally isolated by perfect joints or sutures, and can claim them as three individual elements.

After these, follows the fifth, with a separate block-piece, thought to be the *vomer* of mammals, etc. On it arise exostose-like crested sides, perforated by the olfactory nerves; they are the "laminæ cribrosæ ossis ethmoidalis." These again are overlapped by an often squarish apical platform,—presumably representative of a *pair*, in the schematic idea. This platform, sending down a dividing ridge—*a true lamina perpendicularis ossis ethmoidalis*, (Cuvier)—and joining the block often by a suture, it is therefore the arch-top (not, as Oken and Owen supposed, the ossa nasalia, but) the *lamina perpendicularis* and "crista galli" of mammals. In amphibia and birds, it is more and more overlapped by the expanding forehead, and (the facial bones, such as the nasal ones likewise, covering it) entirely hid from outward view. It follows, moreover, that thus *all* the different segments of these five vertebræ contribute in forming the cranial cavity; very unlike the (merely external) ossa nasalia.

This anterior (olfactory) platform is, backward, followed by the visual or frontal one overlapping most of the profound orbit,—which, as in man, is mainly enclosed by the ethmoidal and the two sphenoid "alæ" or side-slabs: the anterior of which passes the optic nerve, the posterior one the glossopharyngeal nerve,—which, in man, supplies exclusively the region of specific gustation (sour, saltish, sweet, bitter), as I have proved elsewhere. The *frontal bones* are admitted to correspond to the (optic) "alæ sphenoides anteriores," and in fishes extends far backward in the median line, often leaving a median *fontanelle*, as do frequently the insequent, narrowish parietal bones known as the top-pieces of the true sphenoid or gustative vertebra. This is backwardly followed by the lozenge-shaped key-stone, being a cruciate fusion of two pair of top-slabs: the anterior ones appertaining to the petrous or auditory, the posterior to the "condyloid" or "hypoglossic" side-slabs, but partly separated from them by the intervening triad (Oken) of temporal bones, exclusive of the petrous part, and which, in accordance with *Oken's* law—not sufficiently appreciated by his illustrious followers, Agassiz and Gould—is tripartite, typically consisting, *like all* ("glenoid") *fulcra*, of extremities and jaws, a *blade* (shoulder-blade, ileum) and clavicular *prop* (clavicle, os ischii), and an occasionally deficient styloid hook (coracoid, not acromion). In the temporal bones, these are represented by, 1st, the *pro-glenoid* blade, or squama and tuberculum articulare,—in Esocine fishes so extensively developed as to hide from view, and entirely overlap, as a shield, the cartilaginous underlying frontal and parietal bones; 2d, the mastoid *prop;* and, 3d, the *uncinate* —between the condyle-plates and the parietal ones—with its escarped or semilunar base (as an os pubis does a foramen obturatorium) enclosing the deep temporal scrobicle, which is often obturated with a cartilaginous membrane at its depth,—being, in higher animates, the osseous *meatus auditorius externus*, with the tympanum for its obturatory membrane. This third or uncinate element invariably takes a similar part to that of the os pubis to circumscribe an obturatory passage. Hence, in the "shoulders" or fulcrum of the fore-fins of Bubalichthys (buffalo-fish), and similar ones, where the analogy of pelvic structure is tangible, with an arcus pubis, foramen obturatium, etc., its uncinate element is chiefly active in producing this perfect likeness, and thus affording the starting-point or clue for the comparison.

The organs articulating in fishes in the temporal bone's glenoid cavity, (or, as in the cat-fish, Pimelodus, immovably soldered to it,) and known to be the palatal arches in birds, present the exact simile of a bird-shoulder, while actually representing the pterygoid bones as the fulcrum of the palato-maxillary and intermaxillary fabric. The stout clavicular prop of this palatal "tripod" is the *lamina pterygoidea externa* of mammals; the blade, the *zygomatic* bone; the uncus, the *styloid* process. In fishes, the gill-lid acts the zygomatic or blade; the underlying bone that turns in the glenoid cavity represents the prop or exterior pterygoid; and the curved ensiform slab anterior to the gill-lid, the styloid or hook. The ascending maxillary arch is formed by the tabulately developed humerus and forearm of this palatal apparatus; and the maxillary and intermaxillaries, as well as the infraorbitals, are the hand and five fingers, turned backward (comp. Esox estor, Les.) of that fabric. In birds, the lower jaw swings on the processes pterygoidei; in fishes, on the elbow of upper jaw; in mammals, in the glenoid cavity of the temporal bones. In Bubalichthys, the last nuchal vertebræ present all the segments and developments, in a premonitory manner, of the cranial vault, while its tabulate rib-rudiments afford strikingly the inverse likeness of the occipital steep and its condylar passages.

May 2, 1859.

The President, Dr. A. Wislizenus, in the chair.

Seven members present.

A letter was read from the Franklin Institute, Philad., 17 June, 1859, acknowledging the receipt of No. 2 of the Transactions of the Academy.

The following publications were received: Canadian Jour. of Ind., Sci. & Art, for March, 1859,—*from the Canad. Inst.;* Proc. of the Acad. of Nat. Sci., Phil., March, 1859,—*from the*

Society; Pres. Mess. & Doc., Parts II. & III., 8vo., 1858–9,—*from the Hon. F. P. Blair, Jr.;* On Longevity, by Drs. Chaillé and Dowler,—*from the Authors;* Proc. of the Bos. Soc. of Nat. Hist., Jan.—March, 1859,—*from the Society;* U. S. Naval Astron. Exped. to Chili, by Lieut. J. M. Gilliss, LL.D., Vols. I. & II., Wash., 4to.,—*from N. Holmes;* Cat. of French Library,—*from C. Witter.*

Dr. H. A. Prout read a paper entitled "Third Series of Descriptions of Bryozoa from the Palæozoic Rocks of the Western States," and exhibited drawings of several new species.

The paper was referred to a committee.

The committee, to whom were referred the papers by Mr. Reineke on "Pavements," on "Filtration of Water," and on the "Poplar Street Sewer," recommended that the same be filed in the archives for future reference, and were discharged.

Henry Shaw and Edwin R. Mason, Esqrs., were elected associate members.

May 9, 1859.

Vice President Dr. Geo. Englemann in the chair.

Eight members present.

The following books were received: Sketches of the U. S. Coast Sur. 1851, 4to.,—Rep. of U. S. Coast Sur., 1853, 4to., Maps and Views accompanying Mess. & Doc., 1853–5, 4to.,—Patent Office Rep. 1853, Part II.,—1854, Parts I. & III., and 1856,—Lyell's Prin. of Geol., 8vo., 1854,—*from B. A. Hill;* N. O. Med. & Sur. Jour., No. 3, May, 1859,—*from the Editors.*

Mr. Wm. Glasgow, Jr., presented specimens of calcareous deposit upon wooden troughs from the water of the Hot Springs, in Hot Springs county, Ark.; also specimens of *Ulva thermarum*, an Alga found on the water of these hot springs at a temperature of 125° Fahr.

The committee, to whom was referred the paper of Dr. B. F. Shumard, entitled "Notice of New Fossils from the Coal Measures and Permian strata of Texas," &c., reported the same for publication in the Transactions.

Dr. T. C. Hilgard read a paper entitled "Notes on Comparative Organotaxis." The paper was referred to a committee.

Dr. Engelmann read a paper on the "Diœcious Grasses of the United States," mentioned at a previous meeting. The paper was referred to a committee.

Dr. Engelmann also read a paper entitled "A Synopsis of the Species of the Genus *Cuscuta*," which was referred to a committee.

He remarked further, that these curious parasites had attracted his attention about twenty years ago, when he distinguished in our immediate vicinity five or six species, while at that time only one, the *Cuscuta Americana* of Linnæus, was mentioned in the works on North American Botany. He published a first paper illustrated by a plate in the 43d Vol. of Silliman's Journal, (1842,) which attracted some attention, and was favorably noticed and copied into Hooker's London Journal of Botany, 2d Vol., 1843. He had continued his investigations into this genus, in which he was greatly assisted by being enabled to compare the specimens in the collections of many American botanists, obligingly communicated to him, and of the rich herbaria of Sir Wm. Hooker, of Kew, and of the imperial botanic garden at Vienna, which were with the greatest liberality entrusted to him. Meanwhile, different botanical explorers of our country, especially those connected with the Exploring Expeditions to the West and South-west, had furnished him with a great deal of new material. During his recent visit to Europe, the botanical treasures of all the great collections in London, Paris, Berlin, Vienna, Geneva, and other places, were thrown open to him; the Cuscutæ of the Herbaria of the botanic garden in St. Petersburg were sent to him; and many botanists, among whom he would only mention the Nestor of botanists, Robert Brown, since deceased, kindly assisted him with advice and with specimens. He had not yet been able to work out the vast material in his hands into a complete monograph, as he intended to do, but considered it a duty to the scientific men who had so liberally assisted him, not to withhold any longer the results he had obtained so far.

May 16, 1858.

The President, Dr. A. Wislizenus, in the chair.

Twelve members present.

Letters were read from the "Zeeuwsch Genoots. der Wetens.," Middleburg, 17 Nov., 1858,—the "Naturf. Gesells.," Basel, 23 Nov. 1858,—the Roy. Soc. of Sciences, Upsal, 22 Dec., 1858,—the "K. B. Akad. der Wissens.," Munich, 26 Dec., 1858,—the "Oberhess. Gesells. für Natur-und Heilkunde," Giessen, 11 Dec., 1858,—the "Naturf. Gesells. in Emden," 16 Dec., 1858,—the "Naturf. Gesells. Danzig," 16 Jan., 1859,—the "Soc. de Géographie," Paris, 20 Nov., 1858,—the "K. L. C. Akad. der Naturforscher," Jena, 13 Nov., 1858,—the "Verein der Freunde der Naturg. in Meklenburg," 4 April, 1858,—the "Acad. Roy. des Sciences à Amsterdam," 20 Nov., 1858,—the "K. Bergakad. zu Freiberg," 21 Nov., 1858,—the "Naturf. Gesells. des Osterlandes zu Altenburg," 20 Nov., 1858, severally acknowledging the receipt of No. 2

of the Transactions; from the "Verein für Naturk. im Herzogthum Nassau," Wiesbaden, 11 Dec., 1858,—the "k. k. geographischen Gesells.," Vienna, 30 Nov., 1857,—the "Acad. Roy. des Sciences de Stockholm," 15 Nov., 1858,—the "k. Preuss. Akad. der Wissensch." Berlin, 12 Aug., 1858,—severally acknowledging the receipt of No. 1 of the Trans.; and transmitting publications in return.

The following publications were received: Ueber die chem. Constitution organischer Verbindungen von H. Kolbe, Prof. zu Marburg, 1858; Mittheil. aus dem Osterlande, Band XIV., Heft 1—2, 1858, Altenburg,—*from the Society;* Die Athysanus-Arten der Gegend von Wiesbaden, von C. L. Kirschbaum, 1858,—Jahrbücher des Vereins für Naturk. im Herzogthum Nassau, Heft 12, 1857,—*from the Society;* Zeitschrift für die Gesammten Naturw., Halle, Jahrg., 1858,—*from the Editors;* Verhandl. der Russisch-K. Mineralogischen Gesells. zu St. Petersburg, Jahrg., 1857-8.—*from the Society;* Atti del I. R. Istituto Veneto, Tom. III., Ser. III., Disp. 3 & 4,—*from the Society;* Mém. de l'Académie Imp. de Caen, 1856-8,—*from the Society;* Verhandl. des Vereins zur Beförd. des Gartenbaues, Jahrg. V., Heft 1-2, Berlin, 1857,—*from the Society;* Mem. of the Lit. & Phil. Soc. of Manchester, N. S., Vols. XIV. & XV. Part I.,—Proc. of same, Nos. 1-14,—*from the Society;* Mittheil. der k. k. geographischen Gesells., Wien., Jahrg. 1857, Heft 1-2, 1858, Heft 1,—*from the Society;* K. Svenska Vetenskaps-Akad. Handlingar, Ny följd, D. I., 1, 2,—Ofversigt, 1857,—Freg. Eugenies Resa, Häft 1-5,—*from the Society;* Monatsbericht der k. Preuss. Akad. der Wissens. zu Berlin, 1857-1858,—*from the Society;* Reply to the "Statement of the Trustees" of the Dudley Observ., by B. A. Gould, Jr., Albany, 1859; Rep. of Progress of the Geol. Sur. Canada, for 1857,—*from the Survey;* Mess. & Doc., Vols. I. & III., 1858-9,—Rep. on Nav. Contracts, 1859,—*from the Hon. F. P. Blair, Jr.;* Rep. of Explor. Exped., 1842-3-4, by Capt. J. C. Fremont, 8vo., 1845,—*from B. A. Hill, Esq.;* Jour. Franklin Inst., May, 1859,—*from the Society.*

The committee to whom was referred the paper of Professor Russell on "Western Antiquities," recommended that the same be filed in the archives for future reference, and were discharged.

It was voted that the Curators be authorized to engage the assistance of a taxidermist, if necessary, for the better preservation of the zoological specimens in the museum.

The GEOLOGICAL STRUCTURE *of the "Jornada del Muerto," New Mexico, being an Abstract from the Geological Report of the Expedition under Capt. John Pope, U. S. Top. Engrs., for boring Artesian Wells along the line of the 32d Parallel.* By G. G. SHUMARD, M.D., Geologist of the Expedition.

Before entering into a detailed description of the geology of the district of country known as the *Jornada del Muerto*, we will offer a few remarks upon its general features.

It lays immediately east of the Rio Grande, and may be described in general terms as a gently sloping plain, somewhat elliptical in form and enclosed on both sides by lofty mountains. This plain extends from near the southern extremity of the Doña Ana Mountains N.N.W. for the distance of eighty or ninety miles, and varies from twelve to forty miles in width. Near the southern extremity it is partly interrupted by the Doña Ana Mountains, and there its width does not exceed twelve miles; but as we travel north it rapidly widens, attaining its greatest transverse diameter at the distance of twenty or twenty-five miles; it then gradually diminishes until we arrive at the northwestern extremity, where it does not exceed eighteen or twenty miles in width. Throughout the entire length it is marked by a distinct central depression, which, as will be seen hereafter, corresponds pretty accurately with the synclinal axes of the underlying strata.

Wherever examined, the surface formation was found to consist of detritus of rocks in all respects the same as those composing the neighboring mountains, from which it has been doubtless mainly derived. The precise thickness of this deposit could not be very accurately determined, as only a few natural sections were observed, and these only near the base of the mountains. In two localities its observed thickness was nearly five hundred feet.

The two ranges of mountains forming the eastern and western boundaries of the Jornada del Muerto curve gently in opposite directions, and are remarkable for their close general resemblance and simplicity of structure. In each we find a gentle slope towards the plain, and bold and nearly vertical precipices in the opposite direction. Along their summits are exhibited the sharp and jagged edges of their uplifted strata.

The range on the east varies in width from five to fifteen miles, and forms a nearly continuous range extending north and south the entire length of the "Jornada." As will hereafter be seen, it is composed principally of upheaved strata of dark gray, blue and black sub-crystalline limestone, dipping west at various angles. Although these mountains have the same general direction and are apparently continuous with the Organ range, with which they have been hitherto classified, nevertheless their general conformation and structure are totally distinct. In no respect is there the slightest resemblance between them, one being composed almost entirely of sedimentary strata, and the other mainly of eruptive rocks. The cause of the upheaval of this portion of the Organ Mountains is rendered fully apparent by a chain of low igneous hills which have been traced extending along the eastern base for the distance of nearly ninety miles, and which towards the south appear to be continuous with the eruptive rocks of the Organ Mountains.

Upon the western side of the "Jornada" the mountains are interrupted at their northern and southern extremities by broad valleys; the main portion of the range being separated in the one direction from the Fra Cristoval Mountain by an extensive volcanic district, and in the other, from the Robledo Mountain by the valley of the Rio Grande and a chain of igneous hills. Although in general appearance very closely resembling the mountains upon the opposite side of the plain, the central portion of this range is found to differ somewhat from them in composition, the limestone being here overlaid by grits, shales, and sandstone, which altogether present an average thickness of about eight hundred feet, and are uniformly found dipping towards the east. The length of this portion of the range is from forty to forty-five miles.

Geologically speaking, then, the Jornada del Muerto may be considered as nothing more than a simple trough, composed mostly of limestone, sandstone, and shale, and covered to the depth of five or six hundred feet with loose detritus. It is the upheaved edges of these strata that constitute the mountains on either side, their synclinal axes being everywhere strongly marked by the central depression of the plain.

As this trough throughout the greater portion of its length appears to be entirely free from igneous protrusions, I am of the opinion that an abundant supply of water can here always be obtained by means of Artesian Wells. The depth to which borings would have to be carried for this purpose can not very readily be determined, as but few natural sections were exposed upon the plain, and these only extended through a portion of the detritus. But as the Cretaceous sandstone overlying the shale of the Coal measures, which would have to be first passed through, exhibits in the mountains upon the western side of the "Jornada" an average thickness of about six hundred feet, it is probable that water could not be obtained at a less distance beneath the surface than a thousand or fifteen hundred feet.

As the "Jornada," besides its lateral slopes, presents a general one from N.N.W. to S.S.E., the most favorable situation for the experiment would probably be along the central depression marking the synclinal axis of the strata, taking care to avoid, on the one hand, the igneous protrusions, of which the Doña Ana Mountains form a portion, and on the other, the chain of volcanic hills near the north-western extremity of the plain.

Agreeably to instructions, I started from Doña Ana, on the afternoon of the 11th of December, accompanied by Mr. S. Homans, Topographer, Mr. Thompson, guide, six laborers and Mexican packers, and a mounted escort of nine soldiers.

Taking a course in the direction of the north-western extremity of the Doña Ana Mountains, we travelled over red and purple porphyry, greenstone, basalt, and felspathic rocks, usually covered with coarse reddish sand and detritus, bearing a moderately fertile soil. To the south-west and on the opposite side of the Rio Grande, the abrupt edges of upheaved sedimentary strata (Upper Carboniferous) were seen projecting to the height of near a thousand feet, forming the summit of the Robledo Mountain, which presents somewhat precipitously to the east, and slopes gradually towards the west and south-west, where it is abruptly terminated by an igneous peak known as the "Picacho." The Robledo Mountain extends north-west and south-east for the distance of about eight miles; and it appears to be composed almost entirely of stratified rocks, which present an irregular dip of from 10° to 20° S.W. From its north-eastern base to the Doña Ana Mountains, occurs a broad open space, composed mostly of cruptive rocks, which may be traced extending as far as the "Picacho," where they rise above the general surface to the height of eight hundred and fifty feet. After ascending by a gradual slope for several miles, we finally reached the base of the Doña Ana Mountains, and entered a deep and very rugged cañon, where, finding an abundance of water and good grass for our animals, we concluded to encamp for the night.

The Doña Ana Mountains extend in a north-westerly direction for six or seven miles, and are composed of a number of conoidal peaks, the highest of them about one thousand feet above the general level of the plain. Many of them are completely isolated, and, owing to their lower portions being thickly covered with detritus, appear to shoot up abruptly from a smooth and gently sloping plain. The portion of these mountains observed to-day consists of gray and purple porphyry, mica-schist, greenstone, compact quartz, and felspar, most of which appear to be undergoing rapid disintegration, being not unfrequently so soft as to crumble readily between the fingers. The weathered faces are of yellowish, brown, and purple colors.

Dec. 12. Started at 7 o'clock. For the first few hours we continued to wind through deep and rugged cañons, some of which presented nearly vertical sides, exhibiting here and there tortuous veins of greenstone and quartz. As we progressed, the rocks became harder and more granitic in their character until we arrived at the eastern base of the range, where coarse gray porphyritic granite was alone observed.

We next emerged into a broad and gently sloping plain, everywhere covered with short yellowish moss-like grass, and extending uninterruptedly as far as the Organ Mountains. This plain here constitutes the southern and narrowest portion of the "Jornada del Muerto, which, from this point expands rapidly in width and extends many miles in a N.N.W. direction, being bounded on either side by lofty mountains, whose sharp and jagged points appear in the distance rising one above the other in almost endless succession.

Being desirous of commencing the examination of its eastern boundary as far south as practicable, we now travelled in a direction N. 70° E. The first six miles was over a gradual descent, covered with fragments of eruptive rocks, which were surrounded by fragments of dark gray compact subcrystalline limestone, containing numerous carboniferous fossils. We now encountered a more fertile soil, which was covered in places with a luxuriant growth of grass.

Towards evening, we arrived at the western base of the Organ Mountains, and shortly after entered a deep gorge, near the eastern extremity of which we were lucky enough to find a running stream of good water, where we concluded to encamp for the night.

This gorge or cañon extends in an easterly course about four miles, and is walled on either side by rugged and nearly vertical cliffs, which afforded us a fine opportunity of ascertaining the structure of the mountains. These were found to consist of dark gray and bluish sub-crystalline limestone of the upper division of the Carboniferous system and porphyritic granite. The limestone is in massive beds, strongly upheaved against the granite, dipping W.S.W. from 30° to 80°. Its exposed thickness is near two thousand feet. Near the point of contact with the eruptive mass, it is highly metamorphosed, being hard, brittle, and of dingy-brown and black colors. Fossils occur in this limestone in the greatest abundance. In many places, beds of considerable thickness appear to be almost entirely composed of the remains of *Crinoidea*. In addition to these, the rock presents a great variety of other forms, among which we recognize the *Productus cora*, and *P. punctatus*.

The granite was only observed near the eastern side of the mountains, in the form of detached conical hills, above the highest of which the edges of the uplifted carboniferous strata are seen to project many hundred feet. These hills are but spurs of the eruptive portion of the Organ Range, which only a few miles further south rise majestically to the height of several thousand feet. The rocks composing these hills do not differ essentially in composition from those constituting the greater portion of the Organ Range at the south. They are usually of a light gray color, and contain a much larger proportion of felspar than usual, and a deficiency of mica. These everywhere appear to be undergoing rapid disintegration.

Dec. 13. Started at 8 o'clock. Having with some little difficulty regained the mouth of the cañon, we travelled during the remainder of the day in a northerly direction, keeping as near the western base of the mountains as practicable. Our road was over a succession of low hills, composed principally of carboniferous limestone and limestone detritus, the latter often firmly cemented with calcareous matter and containing fragments of quartz and sandstone.

The Organ Mountains, as observed to-day, present an average width of about five miles, and a height above the plains of from two thousand to two thousand five hundred feet. In their general course they appeared to curve gently towards the east, exhibiting a slope to the west and nearly vertical cliffs to the east. Wherever examined they were found to be composed chiefly of massive beds of gray and dark highly fossiliferous limestone. The fossils obtained from these beds seem to indicate that they belong to the Coal Measures, as follows: *Athyris subtilita*, (Hall,) *Spirifer hemiplicatus*, (Hall,) *Productus semireticulatus*, and *Bellerophon*. With these, I found also a slender species of *Chemnitzia*, and numerous columns of *Crinoids*.* These strata are often highly contorted and dislocated, and present a general dip to the W.S.W. of about 45°. In a few places, they are traversed from top to bottom by tortuous veins of compact and cellular quartz. No granite was observed during the day.

The Jornada, with the exception of being much wider, did

* I am indebted to my brother, Dr. B. F. Shumard, for determining the fossils of this paper.

not differ in general appearance from the portion already described. On either side, the surface exhibits a gentle slope towards the centre, and is everywhere covered with moss-like grass. Soil calcareous and moderately fertile.

Towards evening we came to a series of rocky basins, filled with clear water supplied from springs in the vicinity. At this point we concluded to encamp for the night.

Dec. 14. Continued our route in a northerly direction, our road being mostly over rocks of the same character as observed yesterday. In a few places the limestone contained bands of coarse grained yellow quartzose sandstone of the same character as that met with, yesterday, in the detritus. To the east, the mountains are to be seen rising to the height of near two thousand feet, and the edges of the upheaved strata are found overlapping each other in quick succession, presenting abruptly to the east, with a continuous slope to the west, which corresponds very closely with the general inclination of the strata, so that the mountains present the appearance of having been cleft through their centres. After travelling eight miles, we were, in consequence of the severe indisposition of one of the party, compelled to halt for several hours, during which time I busied myself in exploring a rugged cañon that extends through the mountains in an easterly direction. It presents, on both sides, nearly vertical cliffs of limestone, from one to two thousand feet in height, and is terminated abruptly at the eastern extremity by an igneous protrusion of gray porphyritic granite, against which the limestone was observed resting in a highly metamorphosed condition. The line of this igneous protrusion may be distinctly traced along the eastern base of the mountains for a number of miles, appearing everywhere in close contact with the limestone, and rising gradually towards the south, until it attains the height of eight hundred or a thousand feet.

Several large springs were observed near the eastern extremity of the cañon, and I am of the opinion that good water can here always be obtained in abundance.

The limestone was highly charged with remains of *Crinoidea.* I found here, also, *Productus cora*, *P. costatus*, *P. semireticulatus*, *Chonetes Smithi*, *Atrypa*, (Sp. undt.) *Rhynchonella*, (Sp. undt.) *Straparollus catilloides*, *Nautilus*, (Sp. undt.) *Fenestella*, *Syringopora*. These fossils indicate that at least a portion of these strata belong to the era of the Coal Measures. In places, the strata were again found highly contorted, fractured, and, in a few instances, standing almost vertical. The general dip is about 45° west.

By 3 h. P. M., we were again in motion, continuing our northward course over rocks of the same character as before, until we arrived at the San Andres cañon. As this afforded an easy passage through the mountains, and it being desirable to ascertain as minutely as possible the character of the rocks along their eastern base, we here concluded to change our course and enter the cañon. It proved to be exceedingly rough, and presented on either side precipitous walls of massive limestone of about the same altitude as those encountered yesterday. The limestone is here of a much darker color and far more compact than any previously observed. When struck with the hammer it emits a sulphurous odor, but does not differ, palæontologically, from that seen during the morning. In a few places, hard yellowish and brownish quartzose sandstone and dark colored schist were found intercalated.

The cañon proved to be about six miles in length, and from a few yards to a mile wide, and appears to have been hollowed out of the solid rock by erosion. Near the eastern extremity a large stream of clear water gushes out from near the base of the strata, and, after flowing for several hundred yards in an easterly direction, again disappears beneath the surface.

Dec. 15. Shortly after starting this morning we reached thick beds of mica and hornblende schist, which continued to be largely exhibited, until we arrived at the eastern extremity of the cañon. Here the granite was again observed in the form of low conical hills, the highest of them not exceeding four or five hundred feet. Near the point of emergence from the cañon the limestome presents to the east in bold and nearly vertical cliffs, some of which were estimated at nearly three thousand feet in height. In front of these extends the "Valley of the Salt Lakes," which is here about thirty miles broad, and is abruptly terminated on the east by the Sacramento Range, whose highest point, the Sierra Blanca, was seen towering far above the rest, its summit mantled with snow. This range, like the one we have just been examining, bears north and south, and apparently possesses the same geological constitution. Having reached the eastern side of the Organ Mountains, we travelled for several hours in a northerly direction. Our road was for the most part over beds of hornblende and mica-schist and porphyritic granite. The two first reposed upon the last, and were thickly marked with veins of quartz and greenstone. The granite is of a light gray color, decomposing rapidly, and often contains masses of compact felspar several feet in diameter.

Late in the day we arrived at the Pina Blanco cañon, which, like the one we passed through in the morning, appears to have been produced by erosion. On both sides, are bold and rugged cliffs, from fifteen hundred to two thousand feet high. Here the limestone, although strongly upheaved and highly contorted, seems to have undergone but slight metamorphic change. The fossils obtained here are chiefly *Productus costatus*. The thickness of the strata, as well as could be determined from their exposed edges, is about three thousand feet. After travelling several miles through this cañon, we gradually ascended to the summit of the mountains where night overtook us, and we were, for the first time since leaving Doña Ana, obliged to camp without water. Temperature at 12 o'clock P. M., 8° F.

The height of our evening camp, as determined by barometrical measurements, was found to be one thousand seven hundred and eighty-one feet above Doña Ana, and five thousand six hundred and fifty-eight feet above the level of the sea.

Dec. 16. At a little distance from our last evening's camp, we came to a small spring of clear water, impregnated with sulphuretted hydrogen gas. It possesses a slightly alkaline but not very disagreeable taste. Here, we concluded to take breakfast and allow our animals time to graze. After a couple of hours' delay, we again started, taking a north-west course through the mountains, which here are about fifteen miles in breadth, and exhibit sharp and jagged peaks, all of which slope towards the west, and present precipitously in the opposite direction. At a little distance, these appear to rise one above the other in the utmost confusion; but upon a closer examination, they were found to present a distinct linear arrangement, the different ridges corresponding to the edges of the uptilted strata.

During the day, the sandstone was frequently observed, apparently occupying a position superior to the limestone. It nowhere exhibits a thickness of over sixty or seventy feet. It is usually hard, fine grained, and of light yellow and grayish colors. In a few places, it is finely laminated and highly micaceous. The limestone did not differ in thickness, or general character, from that of yesterday. As before, it was found to be rich in organic remains. Among the species collected from it during the day were *Productus æquicostatus*, (Shum.,) *Prod. splendens*, (Nor. & Prat.,) *Spirifer hemiplicatus*, (Hall,) *Fusulina cylindrica*, (Fischer,) and *Athyris subtilita*, (Hall.) All of these fossils are peculiar to the Coal Measures of the Western States. In a few places, I observed veins of quartz. Springs of sulphur water were several times encountered during the day.

Dec. 17. For the first few hours we continued to travel north-west, our road being mostly over rough peaks and through deep cañons, which rendered this portion of the day's march necessarily slow and very toilsome. The strata still preserved a westerly dip and presented precipitously to the east. The weathered faces of the limestone were of a bright yellow color, and often coated with saline efflorescence. When freshly fractured, it exhibited various shades of blue, brown, and black. Fossils of the same character as last mentioned were detected in it, in great numbers, and in many places the strata appeared to be almost entirely composed of Encrinite columns.

Towards noon we again came in sight of the "Jornada," and soon afterwards descended by a gentle slope from the mountains to its eastern border. We then travelled nearly due north over thick deposits, principally of course silicious sand and angular blocks of limestone and sandstone, often firmly cemented with calcareous matter. The surface of the country is hilly, and frequently divided by long narrow ravines, and presents a gentle slope to the west. Near the base of the mountains the sandstone was again encountered, and, in places, presented a thickness of nearly three hundred feet. Wherever seen, it was found resting conformably upon the limestone and with the whole dipping west at an angle of about 30°.

Late in the day we reached a chain of low hills that extend from the mountains several miles into the "Jornada." These are composed chiefly of gray and dark colored limestone. From these the mountains were to be traced northward as far the eye could reach. For the first twenty or twenty-five miles, they appeared not to differ in general composition or character from those already examined; the slope being uniformly to the west. Beyond this, they were seen for the first time sloping east, while the abrupt cliffs faced the west.

Having now carried our explorations northward nearly eighty miles and obtained a tolerably accurate knowledge of the general geological feature of the eastern boundary of the "Jornada," we concluded to devote the remaining portion of the time allotted us for exploration to the examination of the mountains along the western border.

Being disappointed in our expectations of finding water and good grass during the latter portion of the day's march, we were compelled to cross the plain after night, and after a toilsome march of more than four hours we struck the wagon road about three miles north of the "Laguna del Muerto." Our animals now began to exhibit strong symptoms of exhaustion, and we were compelled very reluctantly to encamp for the night with but little fuel and no water.

The "Jornada," at the point we crossed it, is about eighteen or twenty miles wide, and presents a gentle slope from either side towards the centre. The surface of the country is everywhere covered with loose soil and detritus; but their precise character could not, in consequence of the darkness of the night, be determined.

Dec. 18. We arose this morning at an early hour, and by 5½ h. A. M., were again on our journey, taking a southerly course in the direction of the "Ojo del Muerto." Our road was over thick beds of volcanic rocks, consisting of dark colored scoriæ, basalt, greenstone, and other eruptive rocks, most of these apparently undergoing rapid disintegration, and encrusted frequently with a chalky substance. The surface of the ground is thickly coated with coarse reddish sand, and fragments of porphyry, basalt, and other eruptive rocks.

At the distance of three miles we came to the "Laguna del Muerto," an irregular basin-shaped depression in the prairie, capable of containing a large body of water. The floor of this basin appears to be composed of compact igneous rock, which, together with the fact of there being no lateral outlet to it, will sufficiently account for water being found here, sometimes several months after the rainy season. A little north of this we entered a rugged cañon, through which our road gradually descended until we reached the "Ojo del Muerto." Near the entrance of this cañon occurs a chain of low conical hills composed of highly metamorphosed sandstone and gritstone. These are light gray and yellow, and exhibit merely indistinct traces of stratification. The layers are strongly waved, and, as well as could be determined, present a general dip to the east of about 30°.

Passing these hills we again struck eruptive rocks, which continued to prevail largely during the remainder of our morning march. They consist for the most part of vesicular amygdaloid, dark colored scoriæ, and purplish porphyry, all of which appear to be yielding rapidly to the weather, being not unfrequently so soft as to crumble readily between the fingers.

About nine o'clock, we reached the "Ojo del Muerto," a running stream of clear water originating from springs that issue from the igneous rocks. The water is highly alkaline, and has a bitter taste and an odor of sulphuretted hydrogen. The neighboring ground is in places coated with an efflorescence of sulphur and soda.

As it was thought desirable to obtain a knowledge of the country between this point and the "Fra Cristoval Mountain," situated about ten miles distant, I left the greater portion of the party in camp, and, taking with me a sufficient escort, started in a north-east direction. After travelling a mile or more over igneous rocks of the same character as before, we came to thick beds of black scoriaceous lava, which continued to be largely exhibited until we reached the base of the "Fra Cristoval Mountain." This lava stream is about nine miles broad, from four to five hundred feet thick, and appears to have proceeded westward from several distinct points of eruption. To the east, it is everywhere abruptly terminated by a chain of low conical hills that stretch many miles to the north-east, and consist of scoriæ and compact basalt; the former bearing marks of having been subjected to a much more intense heat than any hitherto observed, being light, friable, and resembling highly burnt cinders. From these hills the lava stream was observed gradually descending and branching, it being in a number of places cut through by the Rio Grande, which here winds a tortuous course over volcanic rocks, and affords, by its smooth shining surface and grassy borders, a pleasing contrast to the otherwise barren and gloomy character of the scenery.

Late in the day, we arrived at the "Fra Cristoval Mountain." It is about eighteen miles in length, and rises abruptly to the height of fifteen hundred or two thousand feet. Its general bearing is pretty generally north and south, and its western base is partly washed by the waters of the Rio Grande.

The rocks composing this mountain are principally massive strata of hard blue and gray subcrystalline limestone of the Carboniferous group. In places, the beds are largely composed of the remains of Crinoidea and veins of quartz; greenstone and fibrous gypsum are seen traversing them in various directions. The dip is W. 20°.

From this mountain we obtained a good view of the "Jornada" and the valley of the Rio Grande. The former could be distinctly traced, extending north-west and south-east for many miles, presenting a vast unbroken grassy plain of a somewhat ovoidal outline, margined on both sides by lofty mountain ranges. To the east and south-east, the sharp and jagged edges of upheaved strata are to be seen rising one above the other in quick succession; the range in its course curving gently towards the east, and presenting everywhere a gradual slope towards the plain. To the north, its continuity is apparently interrupted by a broad valley, beyond which, the mountains slope to the east and exhibit precipitous cliffs towards the west. Upon the western side of the "Jornada" appears another range, much shorter, but in all other respects closely resembling the last. This curves gently towards the west, and extends in an unbroken line for the distance of forty or fifty miles. Here the slope is everywhere towards the east, and the mountains appear as if cleft vertically through their middle and the western halves removed. Between the northern extremity of this range and the Fra Cristoval Mountain, occurs a broad open valley, which, as we have already seen, has been, and that, too, at no very remote geological period, the theatre of intense igneous action. With the exception of the portion constituting the river valley, the surface is everywhere rough, black, and almost wholly devoid of vegetation. The lava appears to have undergone but little change since the period of its eruption. To the west, the view is interrupted by the Mimbres Mountains, whose highest point, the Picacho de los Mimbres, I visited upon a former occasion and found it composed of compact purplish granite. The general direction of the range appears to have been pretty nearly north and south, and the mountains, as well as could be determined at a distance of thirty or forty miles, present everywhere precipitously towards the east. Between these and the Rio Grande, the surface is exceedingly rough and broken, being thickly marked with ridges and low conical hills, most of which appear to be composed of unstratified rocks.

Having concluded the examination of the Fra Cristoval Mountain, we again started for camp, which, according to a previous agreement had been removed several miles below to the river valley, and which we reached at a late hour in the night and greatly fatigued.

At camp, the Rio Grande is about one hundred yards wide, flows between low bluff banks of yellow clay, and is characterized by a number of rapids. On either side are hills and ridges of igneous rock, through some of which the river appears to have gradually cut its way. Close to the water's edge the soil is dark, and supports a luxuriant vegetation. Trees, chiefly Cottonwood.

Dec. 19. From our last evening's camp to the northern extremity of the Horse Mountains, our road led over continuous beds of igneous rocks, consisting in part of purple and slate colored porphyry, basalt, greenstone, and granular quartz. The surface is everywhere rough and broken, and divided by cañons with abrupt sides. Through one of these, at least a thousand feet in depth, the river winds a serpentine course.

The Horse Mountains, as observed to day, are from fifteen hundred to two thousand feet high, and present but a single slope, which is towards the east, being, as already intimated, abruptly terminated in the opposite direction by nearly vertical precipices. They are composed of upheaved, and, in places, highly folded strata of sandstone, shale, and limestone, dipping E., from 30° to 70°.

The upper sandstone is fine-grained, micaceous, and of a light gray color, and contains *Inoceramus*, *Cardium*, and other fossils of the Cretaceous Group.* Beneath this sandstone occurs dark bituminous shale, which we regard as forming the superior part of the Coal Measures. Underneath these, again, we have heavy-bedded light gray limestone of the Coal Measures, containing *Fusulina cylindrica*(?), *Productus costatus*, *Athyris subtilita*, *Rhynchonella*, and *Cyathophyllum*(?).

From lithological and palæontological characters, the shale and underlying limestone of this locality must be considered as belonging to the true Coal Measures, and although unable myself to detect any coal, I have but little doubt that its discovery in this region will hereafter reward the researches of the geologist.

Near the western base of the mountains, the limestone of the Coal Measures presents a highly metamorphosed appearance, and here also the cause of the upheaval of the mountains is fully apparent by a chain of low igneous hills, against which the limestone rests, and which are observed extending in a southerly direction for many miles. Wherever examined, they were found to be composed principally of compact reddish granite, mica-schist, and hornblende rocks. West of these, the river still continues to wind through deep and rugged cañons, the sides of which are often precipitous, and appear to be uniformly composed of igneous rock.

Dec. 20. Started at 6 o'clock. Being now distant from Doña Ana, by the shortest practical route, about eighty miles, and having but a scant supply of provisions for three days, to say nothing of the rough and broken character of the country before us, we were during this day necessarily compelled to examine hastily and to avoid as much as possible any great deviation from our general course. Our road was principally along the western base of the mountains, which still maintain an elevation, above the valley of the Rio Grande, of from fifteen hundred to two thousand feet. To the south, they present a gradual descent towards the plain. Occasionally, the strata were again found much folded, and exhibited thick veins of quartz, greenstone, and other eruptive rocks. Externally, the limestone is of a bright yellow color, and, at a distance, resembles very closely that of the mountains upon the opposite side of the "Jornada."

The igneous hills, mentioned yesterday, are still to be observed extending along the base of the mountains, appearing

* In the Report submitted, and which was made in the field, the whole of this sandstone was referred to the age of the Coal Measures. Since my return home, however, a more careful examination of the fossils has at least convinced me that the superior layers; if not the whole of the sandstone, should be classified with the Cretaceous Group. G. G. S.

to be everywhere in close contact with the limestone. At all the points examined, they were found to be composed principally of hard red and purple granite and gray mica-schist. To the west, the surface is thickly covered with coarse angular fragments of limestone, sandstone, and igneous rocks, with occasional seams of sand and reddish clay. These were often found loosely cemented with calcareous matter, and exhibit along the river valley a thickness of about three hundred feet.

The valley of the Rio Grande varies from a couple of hundred yards to several miles in width, and is everywhere clothed with luxuriant vegetation. Soil deep and dark colored.

Dec. 21. Started at half after five o'clock. The country observed to-day does not differ in general appearance from that of yesterday. Our road was mostly along the eastern border of the valley of the Rio Grande, which appears to expand rapidly in width, and is for the most part covered with a dense growth, principally, of cottonwood. Through the valley the Rio Grande pursues a serpentine course over beds of igneous rocks, and on either side occur hills and ridges of red argillaceous clay and detritus; the latter coarser and much more igneous in its composition than that seen yesterday. It appears to be increasing rapidly in thickness, some of the hills being near five hundred feet in height. Near their base, the hills were often found to be thickly striated with horizontal seams of loosely coherent sandstone. To our left, the mountains present an unbroken line of bold precipices, which appear still to be composed of limestone, sandstone, and shale. The thickness of the strata, as well as could be estimated from their exposed edges, is about two thousand five hundred feet. The limestone, as before, was observed resting against an igneous protrusion, and near the junction is highly metamorphosed. Fossils, such as last mentioned, were found in great abundance.

As we travelled south, the igneous hills appeared to increase slowly in height, and in a number of places exhibited dykes of greenstone, basalt, and purple porphyry. These present in their composition a much larger per cent. of felspar and mica than was observed yesterday and a deficiency of quartz. Soil of the valley, dark, porous, and highly carbonaceous. In many places, it was thickly coated with saline efflorescence.

Dec. 22. Started at 4 o'clock A. M. For the first few hours we continued to travel along the eastern border of the valley of the Rio Grande, which is here from four to six miles broad, and exhibits on both sides hills and ridges of detritus. Its surface is in many places boggy and covered with small lakes, the water of some of them being highly alkaline and possessing a bitter taste.

At the distance of six miles, we reached the southern extremity of the Horse Mountains, and entered the "Jornada." At this point, our road was over igneous beds, consisting in part of dark gray granite, porphyry, and hornblende rocks. These appear above the surface in the form of low conical hills, which may be traced, extending apparently in a continuous line from the southern extremity of the Horse Mountains to the San Diego Mountain, a little to the south of which they bend gradually to the west. To the east, the surface is for several miles broken and hilly; after which, the eye encounters naught but a smooth and gently sloping plain, everywhere covered with short yellowish grass, and exhibiting near the centre a marked depression. The "Jornada" here, as well as elsewhere, appears to be composed of detritus, the thickness of which could not be determined. In some of the neighboring ravines it presented sections of nearly five hundred feet.

About eleven o'clock, we reached the San Diego Mountain, which rises in the form of a solitary peak to the height of nearly a thousand feet, and is evidently of much more recent origin than any of the others examined. Its axis runs pretty nearly north and south, and, as far as we were able to judge from a distance, is composed of granite. Near its western base we observed heavy beds of quartz, porphyry, and greenstone. Against the sides of this mountain the quaternary deposits were seen strongly upheaved and highly metamorphosed, dipping both to the east and the west, at an angle of about 70°, and exhibiting shades of light yellow, red, purple, and black. The layers comprising them are for the most part firmly consolidated, and have a thickness of about five hundred feet. Black ferruginous sand was discovered in great abundance in this neighborhood.

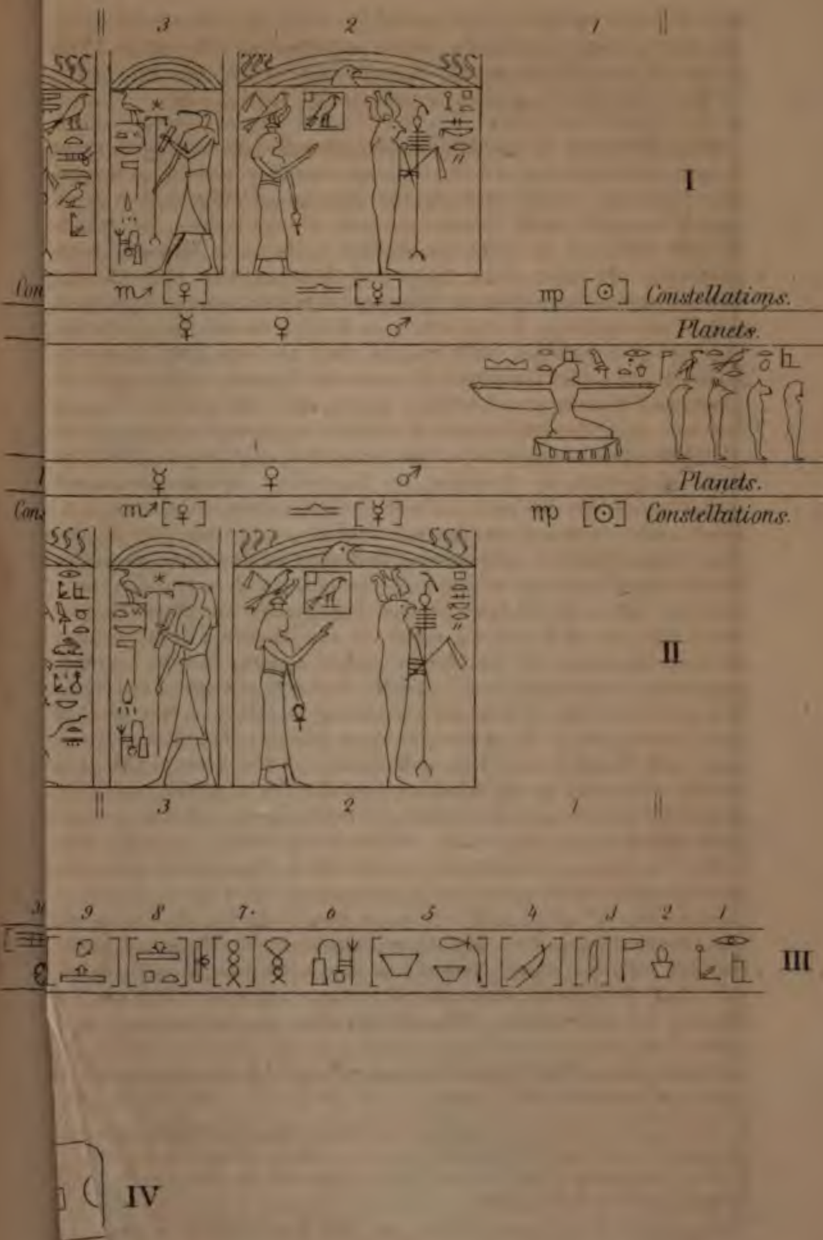
From the San Diego to the north-eastern extremity of the Robledo Mountain the country appears to be composed almost entirely of igneous rocks. Near the point where the road descends from the "Jornada" into the valley of the Rio Grande, the rocks are well exposed, and here consist, for the most part, of gray, reddish, and slate-colored trap. Through a portion of these the river cuts its way, and then flows for several miles along the eastern base of the Robledo Mountain, having to the east of its course a broad valley, covered with a moderately fertile soil.

AN ASTRONOMICAL INSCRIPTION *concerning the year* 1722 *B. C., explained by* G. SEYFFARTH, A.M., PH.D., D.D., *Prof. in the Concordia College, St. Louis, Mo.*

The Museum of the Philosophical and Literary Society of Leeds, in England, has been in possession, for more than thirty-five years, of a very remarkable Mummy-Coffin, which literally is covered with paintings and hieroglyphics, of which Mr. W. Osburn, in 1828, published a learned Memoir with plates.* At that time, however, neither the key to the hieroglyphics, nor that to the astronomical inscriptions, was as yet discovered; for, in 1828, as I have shown in my Summary,† Champollion still taught that the one half of every hieroglyphic text consists of symbolic figures, which may be explained to suit every body's fancy, the other half, of mere letters; that the astronomical figures represent deities, as of medicine, philosophy, love, theft, murder, and so on; that the rows of deities, so frequent on Egyptian monuments, were understood only by such as were in the secret of the mysteries; and it was not yet known that no one of the 630 Egyptian hieroglyphics is symbolic, but that each expresses *syllabically* the letters contained in its name; that the 7 Cabiri and the 12 Great Deities of the Egyptians signified simply the 7 planets and the 12 signs of the Zodiac; that, finally, the combinations of the Cabiri with the other deities express planetary configurations. As Mr. Osburn always "followed the system of Mr. Champollion, being entirely convinced of the correctness of the principle upon which it is founded," nobody will wonder that his explanation of the hieroglyphics is wholly destitute of foundation, and that he mistook, entirely, this very important astronomical inscription. A few examples will demonstrate this. "The God Ptah," says Mr. Osburn, "is that personification of the God Ptah which governs the destinies of disembodied spirits after they have attained the regions of happiness. It is on this account that he is so frequently depicted on Mummy-cases and other funereal monuments. In the first shrine (on the coffin) is that form of the God Ptah, the hieroglyphic name of which is Tore or Tre, i. e., the beetle. Thoth (in the second shrine), the

* An Account of an Egyptian Mummy, presented to the Museum of the Leeds Philosophical and Literary Society by the late John Blayds, Esq., drawn up at the request of the Council, by W. Osburn, junior, F.R S. L., Secretary of the Society, with an Appendix containing the chemical and anatomical details of the examination of the body by Messrs. E. S. George, F. L S., Secretary of the Society, T. P. Teale and R. Hey, Leeds, 1828, 51 pages in 8vo., with 5 Plates.

† Summary of Recent Discoveries, etc., New York, 1857, page 31.



L. Gast & Bro. lith.

twice great Hermes of the Greek authors, was the inventor of the art of writing, and presides over it in an especial manner. His office was also to conduct the soul to the bar of Osiris, in Amente, and there to appear as its advocate with that deity. Thoth, in that *mystic picture*, faces in the opposite direction to the other deities, and is *evidently* in the act of making intercession to them on behalf of the deceased."

Since 1833, we have known that those Ptahs, Thoths, and Tores signify simply the planets, Mars and Mercury, and the Moon.

Regarding the key to the astronomical Egyptian monuments, it was found in the following way. First, Diodorus Siculus, and many other reliable authors, testify, that the Egyptians had observed innumerable planetary configurations, and represented them on their monuments from the earliest times.* Consequently, a great many of those monuments, seen by Diodorus and others, being still in existence, the astronomical inscriptions of Egypt can not have disappeared entirely. Further, Chæremon, an Egyptian priest, says expressly that all the deities of his country signify the planets and the Signs of the Zodiac and its subdivisions.† The same we find in Aristotle, and many other Greek and Latin authors, referring their own gods to the Planets and the Zodiacal signs, which verifies the statement of Chæremon‡. For, since all the Pagan nations, according to Jeremiah 51, 7, brought their Mythology with them out of Babel; since Plutarchus testifies that there was no difference between the deities of the North and the South, the East and the West§; and since all the people of antiquity worshipped 7 Cabiri and 12 Great Gods; it is obvious that the Greek and Roman deities as well as the other Pagan gods really referred to the 7 planets and the 12 Signs of the Zodiac. From such passages I concluded that all the Egyptian monuments, containing certain rows of deities, expressed certain planetary configurations mentioned by the ancient authors.

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* Diodor. Sic. I., chap. 81, 83: *τὰς περὶ ἑκάστων ἀστρων ἀναγραφὰς ἐξ ἐτων ἀπίστων τῷ πλήθει φιλὰττουσιν.* See my Systema Astronomiæ Ægyptiacæ quadripartitum, etc., Lipsiæ, 1833.

† Porphyrius in Jamblichus' De Mysteriis Ægypt., page 7: "Chæremon," says Porphyrius, "aliique multi nihil quid agnoscunt, ante mundum nunc adspectabilem, neque alios Ægyptiorum, in ipsis scriptorum suorum exordiis, ponunt Deos, præter vulgo dictos planetas et Zodiaci signa."

‡ Aristotle, Metaphys., XI. 8, says: "It is related by the Ancients that the Planets and Constellations are deities;" and in other passages he refers the 12 Great Gods to the 12 Signs of the Zodiac.

§ Plutarch De Is. et Osir, p. 377, says: "There is no difference between the deities of the Greeks and those of the Barbarians—those of the southern and of the northern nations."

Now, the question was, what Egyptian gods referred to the 7 planets, and by what deities the Signs of the Zodiac and its smaller parts were represented. As to the planetary deities of the Greeks and Romans, their names are known and still used in all modern languages. The names of the Roman 12 Great Gods and their respective Signs of the Zodiac, are specified in the so-called Calendaria Rustica and other ancient authors. Comparing the names of the planetary gods with those of the Zodiacal gods, we find, as Lucianus already mentions, that some of the 12 Great Gods were called by the names of some Cabiri*. Thus, e. g., both the second planet and the fourth Sign of the Zodiac were called Mercurius; of which ambiguity the reason was this: The Zodiac, the starry belt within the limits of which the sun, moon, and planets perform their revolutions, was divided, according to the 12 months, into 12 equal parts of 30 degrees, and each of them was presided over by one of the planets, viz., in conformity to their natural order, Saturn, Jupiter, Mars, Venus, Mercury, Moon, Sun. Therefore, then, some of the Greek and Roman planets, and some of the 12 Great Gods, being the presidents of the 12 Signs, were synonymous; and for that same reason some of the 12 months, corresponding with the 12 Signs, also bear the names of some of the planets, e. g., March. The same is the case with the Egyptian Cabiri and Great Gods; for, e. g., Thoth (Mercury) signified both the planet Mercury and its Sign in the Zodiac, the Cancer; and also the corresponding month of the Egyptian year, called Thoth. In order to distinguish homonymous but different deities, the ancients applied certain Distinctiva; as surnames, the residence, the parents, peculiar insignia, and so on. The Egyptians, as we shall see, signalized the Cabiri by putting a sceptre in their hands; the Zodiacal deities, by a bath-measure upon their heads; synonymous gods, by mentioning their offices.

As, then, the astronomical signification of the single Greek and Roman Cabiri and Great Deities, both male and female, was known, it was possible to determine, also, by what names and images and symbols the Planets and Signs of the Zodiac, and its other segments, were expressed on Egyptian monuments. The first elements of the Egyptian astronomy are made out in Jablonski's Pantheon Ægyptiacum, 1780, where the learned author, by the aid of innumerable Greek and Roman passages, shows what Egyptian deities corresponded with the Greek and Roman Cabiri and Great Gods, i. e., with the Planets and Signs of the Zodiac.

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* Lucian. Jup. Tragœd. § 18, page 245: Τέλειοι θεοὶ ἕπτα, τρεῖς μὲν ἐκ τῆς παλαίας βουλῆς τῆς ἐπὶ Κρόνου, τέτταρες δὲ ἐκ των Δώδεκα.

Finally, the question was, by what method the Egyptians determined the places of the planets, and represented planetary configurations. This question is answered by the Nativity of a certain Anubio, specified upon an Egyptian payrus-scroll, written in Greek.* From this authentic witness we learn, first, that the ancient astronomers determined the places of the 7 planets not according to constellations of the Zodiac, but according to its movable signs. The constellations of the heavens move, as is known, every year, 50″ 2‴; every 72 years, nearly 1 degree; every 2146 years, nearly 30 degrees, i. e. an entire Sign. This phenomenon is called the Recession of the equinoctial points, because the point of the ecliptic occupied by the Sun, while the day and the night are of equal length, does not remain the same; it moves from East to West in the ecliptic, i. e., the stars of the ecliptic move from West to East, 50″ 2‴, every year. It is known, also, how many Signs and degrees each constellation of the Zodiac, since its determination, advanced from West to East, viz., 107 degrees. For, the originator of the Zodiac, as we learn from the ancient astronomers, proceeded in this way. He divided the whole Zodiac into two equal parts, the limits of which were the points of the winter and summer solstices in the Ecliptic. Then, he divided again the one and the other said part into six Signs, and combined with them the natural file of the planets, making each of them the master of a Sign on each side. It is on that account that the 12 Signs of the Zodiac were called the houses of the planets, and their masters, the planets, named Œcodespotæ (lords of the houses). Thus, then, Saturn, the slowest of the seven planets, became the Œcodespota of the two Signs next the winter solstice, East and West of it; the adjacent ones on both sides were assigned to Jupiter, the following ones to Mars, Venus, and Mercury. Finally, the Signs opposite to the houses of Saturn, being East and West from the summer solstice, were appropriated to the Sun and the Moon. As, then, every planet, except the Sun and the Moon, had two houses each, the Ancients, in order to distinguish the two Signs of the same planet, made the one male, the other female; and thus it is clear, why the 12 Œcodespotæ, or the 12 Great Divinities of all the ancient nations, consist half of male, half of female deities.

Further, the originator of the Zodiac took care to express its 12 constellations by certain images taken from the common life, he proceeding thus: According to ancient Mythology, each object of nature belonged to one of the planets, viz.,

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* See the *Fac simile* in Young's Hieroglyphics, Vol. II., Pl. 52, and its explanation in my Astronomia Ægyptiaca, p. 212.

to that of which the true or imagined nature was most related to the object. Libra and Cancer, e. g., oscillate, and go backward, like Mercury; wherefore they were chosen as symbols of Mercury's houses, viz., Cancer and Libra, and so on. For the same reason all deities of the Greeks, Romans, Egyptians, and other nations, were represented with animals on their side, or bearing their heads, because the latter belonged, as the ancients say, to the Ducatus, i. e., to the department of the respective deities. The following scheme will show the original condition of the Zodiac, its constellations, and their Œcodespotæ, or planetary Directors:

Aquarius.	*Capricornus.*	*Sagittarius.*	*Scorpio.*	*Libra.*	*Virgo.*
[Saturn.]	[Jupiter.]	[Mars.]	[Venus.]	[Mercury.]	[Sun.]
WINT. SOLS.					SUM. SOLS.
[Saturn.]	[Jupiter.]	[Mars.]	[Venus.]	[Mercury.]	[Moon.]
Pisces.	*Aries.*	*Taurus.*	*Gemini.*	*Cancer.*	*Leo.*

These constellations of the Zodiac, as is known, have retained their names and places up to this day, because their images were linked to certain stars, and therefore they originally comprised partly more, partly less, than 30 degrees. But the Houses of the Planets, the Signs of the Ecliptic, changed their places; and 2146 years after 5870 B. C., i. e., the birth-year of that Zodiac, the constellation of Capricornus did not stand in the House or Sign of Saturn, but in that of Jupiter, and so on.

Besides, every Sign was subdivided into 3 Decuriæ, 5 Horia, 12 Dodecatemoria, and 30 degrees, as the Ancients relate; and each of these zodiacal subdivisions was also presided over by a planet; consequently, they were also movable like the Signs.

The first, then, we learn from the said Græco-Egyptian papyrus is, that the Egyptian astronomers determined the places of the planets, observed at any time, not according to the constellations of the Zodiac, but according to its Signs, which were always 30 degrees in length. That same autograph informs us, that the Egyptians in their Nativities mentioned not only the Signs, but also their subdivisions, the Decuriæ, Horia, and so on, with which each planet was then in conjunction, or within the limits of which the respective planet appeared; the reason of which use is the following. As the Egyptians believed that not only each planet, but also each segment of the Zodiac, was invested with peculiar powers, and that the efficacy of the single planets was modified by the Signs, Decuriæ, and other parts of the Zodiac, with which the planets were in conjunction, the Egyptian astronomers considered it necessary, also, to mention the smaller parts of a Sign, containing a planet, in order to show what influence they would exert upon the future life of the respective child, year, period, and so on.

Finally, we learn from Firmicus, Pliny, and the monuments themselves, that the Egyptians, Greeks, and Romans observed planetary configurations on the four Cardinal days, i. e., on the days of the Vernal or Autumnal equinox, or those of the Summer and Winter Solstice, always previous to the births, or historical events, which were to be fixed astronomically.* All these matters have been discussed *in extenso* in my Egyptian Astronomy; and this is, in a few words, the key to all the astronomical monuments of antiquity, and, of course, also to the Leeds Mummy-Coffin in question. By the instrumentality of that key the following 35 astronomical inscriptions have been deciphered, concerning the astronomical years:

2781	B.	C.	The Nativity of the Egyptian empire.
1832	"	"	That of Pharaoh Amos; XVIIIth Dyn.
1781	"	"	That of Pharaoh Osimandya, Sesostris, XVIIIth Dynasty.
1693	"	"	That of Pharaoh Ramses Meiamun, XVIIIth Dynasty.
1631	"	"	That of Pharaoh Sethos, XIXth Dyn.
1578	"	"	That of Pharaoh Raphaces, XIXth Dyn.
1523	"	"	That of Raphaces' vicegerent, XIXth Dyn.
1108	"	"	That of a private individual.
786	"	"	That of an Egyptian priest.
777	"	"	That of the Greek Olympiads.
752	"	"	That of the city of Rome.
660	"	"	That of an Egyptian priest.
630	"	"	That of an Egyptian priest.
489	"	"	That of the battle near Marathon.
479	"	"	That of the battle near Salamis.
396	"	"	That of an unhappy year of the Romans.
216	"	"	That of the battle near Lacus Trasimenus.
61	"	"	That of the Emperor Augustus.
39	"	"	That of Tiberius.
26	"	"	That of a private individual.
22	"	"	That of a private individual.
8	"	"	That of Claudius on the Ara Capitolina.
7	"	"	That of Claudius on the Ara Borghese.
9	A.	C.	That of Vespasianus.
13	"	"	That of Caligula.
37	"	"	That of Nero on the Zodiac at Paris.
37	"	"	That of Nero in the temple at Dendera.

* Firmicus Matern. Astronomicon libri octo. See my Berichtigungen der alten Geschichte, cet., 1855, p. 204.

50	A. C.	That of Domitianus.
54	" "	That of Trajanus upon the Isis-table.
74	" "	That of Hadrianus on the Corinthian Ara.
75	" "	That of Hadrianus at Daphni.
131	" "	That of a private individual.
137	" "	That of Anubio in a Greek papyrus.
138	" "	That of a private individual.
255	" "	That on the ruins of Palmyra.

Before we proceed to the astronomical inscription on the Mummy-Coffin of Leeds, it will be necessary first to examine its historical part.

The name and character of the deceased are, as Mr. Osburn relates, repeated more than fifty times on the coffin. (See Plate X., No. III.) Some of these hieroglyphic groups are missing, or inserted in different places; they are included by crotchets [ ] upon our Plate. The whole hieroglyphic legend contains the following 33 words. For the pronunciation of the Egyptian hieroglyphic figures, see my "Gramatica Ægyptiaca."

1. The first group, the eye and the throne, followed by the figure of a man, signifies: a very holy or reverend person. For the throne expresses syllabically the Coptic word *osh*, multum; the eye, the Coptic *her*, sanctus and reverendus; and the human figure, the word *ham*, homo. Mr. Osburn, according to Champollion's System, takes this group for a symbolic representation of the god Osiris, and, although no trace of an adjective form of Osiris is visible, changes the substantive into an adjective, and finally he brings out the nonsense, *Osirian.*

2. The perfuming-vase, in Coptic *kere*, which often occurs determined by the sparrow-hawk, bearing a human head, and signifying the soul (*kor*), as Horapollo testifies, expresses the Coptic and related words, *uro*, *huro*, *herus*, Herr, *κύριος*, the lord.

3. The hatchet, *hater*, followed by the leaf, *es*, which in the Coptic language characterizes substantiva abstracta, gives the Coptic: *hetor-es*, potentia, munus. Thus, then, the deceased is called: *osh her ham hur hetor*-es, i. e., the reverend lord of the office, viz., the following. Mr. Osburn translates; "the incense-bearer," probably because the perfuming-vase, according to Champollion, signifies incense; and the word office, the hatchet, was then equivalent to bearer.

4. The Egyptian pick-axe, *mahro*, is an usual sign for the genitive-case, the Coptic *m*, of, preceding the word scribe, clerk, (No. 6). Why Mr. Osburn took that hoe for *and*, is hard to explain.

5. The vase pouring out water, *wote*, is translated in the

Rosettana by ἱερός, priest; in the Coptic *woteb*, *web*, sacerdos; and the following Epha-measure, in Coptic *epe*, *hepe*, give the word *hop*, operari, ministrare, and *hiwi*, collecta, tributum. Consequently, the deceased was a priest in the office of ministering the tributes.

6. A composition of three different hieroglyphics, viz., the branch of a reed (*kam*), the globous vase (*nun*), and the sack (*sok*), which is translated in the bilingual Inscription of Rosetta by γράμματα, in Coptic, *kom en skai*, literatura; then scriba, recorder. Mr. Osburn translates correctly, scribe or clerk, in consequence of a mere conjecture.

7. The weft of hair (*hopt* and *hotp*), followed by the chain (*hot*), which is wanting in some places, and also by the papyrus-scroll (*hopt*), the sign of the plural, expressed the Coptic words, *boti*, *woti*, fructus, proventus terræ, and *hoti*, tributum, debitum. Thus, then, the deceased was a priestly clerk for the collection of fruits, or grain.

8. This group, in some places, stands for its first figure, a table with a cup, which gives syllabically the same letters *hotp*, *hopt*, offerre; because the first hieroglyphic was called in Coptic *htop*, and *hepot*. The whole group, then, sounds: *h*, *t*, *p*.

9. This group is put in other places for Nos. 7 and 8, giving the same sense in other words. For, the kernel or grain (in Coptic, *boti*, *woti*, *utah*; fructus, proventus) expresses the word fruits, the Egyptian tithe; and the added figure, a cup upon a table (*hepot*) gives again offerre. Mr. Osburn translates Nos. 7, 8, 9, ingeniously, the devoted of the provender.

10. The hatchet (*hater*) expresses, as we have seen, *hetor* (deus, divinus), being translated in the Rosettana by θεός, god.

11. The house (*kot*) gives the same word *kot* (domicilium), and with the preceding *htor* (deus): house of god, temple, divinum ædificium, ἱερόν, as the Rosettana translates this combination of the house and the word god. Mr. Osburn took that house, although its door and roof are very visible, for a shrine.

12. This group stands in many places for the hatchet and the house, giving the same sense. For, the square, or fenced farm (*tene*), including the word *htor* (deus, divinus), translates: the dwelling, or domicile (*tene*) of god, i. e., again, the temple.

13. The pond (*mone*), and the bull (kalu-ki), at No. 18, alternate in many places; wherefore they must contain similar ideas. Indeed, both words following Nos. 7, 8, 9, signify being augmented by the sign of plural (*wi*), the word *amoni* (possidere, pervenire), and the word *kalo* (deponere), altogether, the fruits or tributes of grain belonging to and offered to the temple. Mr. Osburn translates the pond, although

augmented by the sign of plural, by servant; and the bull, the bulls of Amon; which I do not understand.

14. The waves (*nun*) express the most common form of the Coptic genitive (*n*); and the subsequent three hatchets (*hater*), signifying the plural of *htor* (gods), have been explained above. This group, standing in some places for Nos. 11 and 12 (temple), gives the sense: those fruits were presented to the gods.

15. The baking dish (*nub-t*) with the usual signs of plural, expresses the so frequent word *neb-wi* (domini), lords. Thus the gods are called the lords of Egypt. For,

16. The reed (*kam*) expresses the vulgar name of Egypt (*kam*, *keme*), and the joined plan of a city (*baki*) gives the word *baki* (civitas, terra), together, *kam baki*, the land of Egypt.

17. Another kind of reed (*kam*) with the same determination; and from the Rosettana we learn that both groups signify the Upper and Lower Egypt (τὴν ἄνω καὶ τὴν κάτω χώραν). The plan of a city, not being necessary for understanding, is sometimes omitted.

18. The bull (*kalu-ki*), expressing the participle of the Coptic root *kalo* (deponere), stands, as we have seen, for the pond *amoni* (possidere, pervenire); and the following groups are also synonymous with the groups following the pond. For,

19. The plan of a house (*ahe*), preceded by the said sign of the genitive, and followed by the usual article *pe* (the), expresses in the Rosettana the Coptic *ahe* (dwelling, domicilium). Besides, the waves (*nun*) signify very often the preposition in, the Coptic *en*.

20. The feather (*a*), a piece of cloth (*m*), and the waves (*n*), give the well known name of the god Amun; in the Coptic, the illustrious one; who was, in higher respects, the Creator, but commonly the Sun-god. The group following the name of Amun, viz., *ahe pe* (the house), precedes it in some places, since it was the same to say, the house of Amun, or Amun's house.

21. The pupil, from the root *hra* (videre), expresses the word *heri* (herus, Herr, lord), and then *hra*, *re* (ἥλιος, the Sun), to which is added the usual article *pe* (the). As they immediately follow the group *Amun*, the whole expresses *Amun-Rha*, the Sun-god.

22. The flax-plant, in Coptic *shento*, *sadin*, gives the word *suten* (governor, king), as the Rosettana proves. The subsequent mount (*towe*), is added often to hieroglyphics in order to indicate their syllabic pronunciation; it frequently, however, makes participles out of infinitive moods, like the Coptic *t* appended to verbs.

23. The hatchet and the plural termination express, as we have seen, *hetor-ui*, the gods.

24. The vulture, in Coptic *amoni*, gives the word pascere, nourish, in Coptic *mone;* and the added mount changes the root into a participle, or into the substantive pastor (*mone-ut*, or *et-mone*). In order to determine this same signification, the whip (*biki*) is connected with the vulture, expressing syllabically the word pastor, in Coptic *bok*.

25. By means of the breast, in Coptic *ken*, followed by the sign of syllabic pronunciation, the mount, and the flax-stalk, the letters *kns* are expressed, which correspond to the name of an Egyptian deity, *Chons*, i. e., Hercules. For, this word is related to the Coptic *kons* (vis, power), and to the Greek χθών (the earth, mundus), which word belongs, as the Lexicographi say, to a foreign, i. e., Egyptian root. In short, that so frequent *kons*, in its first meaning, was the earth, and then the god of the earth, Hercules. Thus, then, Amun (the Sun) is called here the herdsman of the world. Mr. Osburn obtains this nonsense: the Osirian scribe of the provender of the bulls of Amun, Neith and Ooh-n-sou. These bulls of Amun, Neith and Ooh-n-sou, formerly totally unknown, are some of the extravagant children of Champollion's system.

26. Instead of Amun, the illustrious one (No. 20), some places of the coffin contain the letters *mnt*, preceded by the genitive sign, which group, on astronomical monuments, refers to the Sun; and, being derived from the root *mnut* (custos), signifies a watchman, who, like the sun, never sleeps. This group is also followed in other places by the pupil (*hera*) and the article (*pe*), i. e., the Sun, as we have seen; consequently, *Mnut* was another name for the Sun-god.

27. The man (*ham*) holding a crook (*boki*), is also an expressive title of the Sun-god, meaning a governor; in the Coptic, *ham bok*.

28. The baking-dish (*nub-t*), which in some places stands for No. 27 (*ham-bok*, governor), commonly expresses the Coptic *neb* (dominus), as we have seen.

29. The sceptre (*kam*) with the sign of syllabic pronunciation, followed by the plan of a city (*baki*), i. e., a country, signifies Egypt on the Lateran Obelisk, and expresses exactly *kam*, *keme*, the vulgar name of Egypt.

30. In one place the gridiron, in Coptic *kera*, is interposed for the purpose of mentioning the older name of Egypt, known from the Bible, viz., Mizraim. For, *kera* corresponds to *kor*, *zor* (fortis, validus), and Mizraim is a composition of the roots, *ma* (locus), *kor* (validus), and *aim*, the Hebrew dual mood, because Egypt consisted of two parts, the upper and lower country. Thus, then, the Sun is called the watchman of Egypt, the land of power, or the mighty country.

31. Now, we come to the name of the deceased priestly officer, which consists of two different words. The first contains the letters N K S I, which in many places (see Lepsius' Todtenbuch, cap. 149, 25) signify ratio, modus; in Coptic *nka-s* (ratio, modus). The following figure, a papyrus-scroll, which is wanting in other places of the coffin, signifies, as we have seen, the plural (*hwo*), and then translates virtutes, instead of virtus, or ratio. Mr. Osburn, taking the handkerchief (*kaisi*) for a *t*, and the scroll (*hop-t*) for a *p*, pronounces *Natsif*.

32. The name of Amun (the illustrious one) which has been discussed sufficiently, and the subsequent determinative, a man (*ham*) holding a whip (*biki*), signifies a servant, or a subject (*ham-bok*), a servant of the Lord. The whole name, then, is *Enkasiw-Amun*, i. e., imago Ammonis, the likeness of Amun, or, as the Greek papyri briefly translate, Ammonius. Mr. Osburn's *Natsif-Amun* remains irreconcilable to any Coptic root. Besides, many proper names occur in the Egyptian literature similarly composed, e. g., *Enkasi-Chons* (the likeness of Hercules), *Enkasi-Amone* (the likeness of the Nourisher).

33. Finally, the ell (*mashi*) and the plumb-line (*moshi*), which always follow the names of deceased pious persons, signify a righteous man (*mashi moshi*, justus justificatus).

The whole of this historical inscription on our coffin pronounces thus: *Osh heri, ker hetors,* [*em web hob hiwi*], *kom en skai hebote* [*hoti*] *huo hotep* [*boti hoteb*] *kot htor* [*tene hetor*] *amoni-we en htor-htor-htor, neb-wi keme* [*baki*] *keme* [*baki*], *kalo-wi en pe ahe Amun, pe Ra, suten htor-wi, et mone bok kons, en mnut, pe Ra, ham-bok* [*neb*] *keme* [*kor*]*: Enkasi-w-Amun, ham-bok, mashi, moshi;* of which the following is a translation:

The reverend priest ministering the tributes, the lord of the clerk-office in the temple of Mnut, the Sun, who is the lord and governor of Keme-Zor (Egypt); caring for the fruits tributed to Amun, who is the royal watchman of the earth, [to the house of Amun, the Sun-god, the lord of the gods], offered to the gods, the lords of Upper and Lower Egypt, namely, Enkasiw-Amun, the servant, the righteous man.

At what time may this so distinguished person of Egyptian biography have lived? Of what age may that costly Mummy-Coffin of Leeds and those dies be, which have preserved for us, during so many revolutions of the sun, such an extraordinary monument of the arts and the science of the ancient world? This question is answered first by two royal cartouches found on the neck of the mummy itself (see Pl. X., Nos. IV. A. B). Mr. Osburn relates that, "during the operation of unwrapping the mummy, a singular ornament, composed of three straps of red leather, was discovered, which contained the said royal names. The figures and hieroglyphics upon this ornament, formerly worn on the neck, are evidently the impressions of heated metal types."

The royal cartouches in question refer to two different Pharaohs, the first expressing a sacred, the other a vulgar name; and it is known that to every Egyptian king belonged two names of that kind, which commonly were put in juxtaposition. The shrine *A* is a sacred name, containing the letters R M S S T P N-R A, i. e., Ramses, the favorite of the Sun, which on innumerable monuments, e. g., on the Obelisk on the Porta del Popolo in Rome, translated by Hermapion, and on the famous Osimandyeum of Thebes, the ruins of which belong now to the village of Karnak, precedes the royal vulgar name of Osimandya (Osimantwa), or rather Osimanpta, as the monuments read. The cartouche *B* contains also a well known name, that vulgar of RaMSeS Me-AMuN, i. e., the Son of the Sun, the friend of Amun; to which belongs, on innumerable monuments, the sacred cartouche, containing the hieroglyphics, Pupil, Fox-head, Ostrich-feather. From the Table of Abydos, now in the British Museum, which contains a Catalogue of all the Egyptian kings reigning successively from Menes, 2781 B. C., down to the said Ramses Meiamun, we learn that Osimanpta was the father of Ramses Meiamun; and Manetho shows us that both the kings reigned simultaneously during 68 years, after the father, Osimanpta, had governed 5 years alone. For the reason of their simultaneous government the Egyptian monuments usually combine the names of both the kings, especially the Obelisk on the Porta del Popolo, praising the combined government of Osimanpta and his son, Ramses Meiamun; and for that same reason the decoration of the Leeds Mummy also puts both the cartouches in juxta-position.

Thus, then, the age of the deceased is nearly determined. For, the Table of Abydos names 38 kings from Menes, 2781 B. C., down to Ramses Meiamun; and supposing each of them had reigned 30 years, we come down to the year 1671 B. C., with which the life of the Leeds Mummy may nearly have coincided. Eratosthenes (born 273 B. C.), the Greek translator of the Table of Abydos, as I have shown in another place*), specifies 1076 years intervening between Menes and the death of Ramses Meiamun, with which the XVIIIth Dynasty of the Egyptian kings, in 1705, would have expired; but in Eratosthenes' Laterculum one king, probably by his copyists, is omitted, and the whole of the historical literature

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* Verhandlungen der K. Saechs. Gesellschaft der Wissensch. 1848, page 71. See my Theologische Schriften der alten Ægypter, cet. 1855, page 94.

of the ancient world does not, in consequence of the carelessness of transcribers, contain a single figure that, being alone, is very reliable. Manetho specifies also the number of the years of the government of the kings from Menes down to Ramses Meiamun; but there is such a discrepancy in the figures in the copies of Africanus, Eusebius, the Armenian Eusebius, and in Syncellus, that it is impossible to fix exactly the governments of Osimanpta, the Great Sesostris of the Egyptians, and of Ramses Meiamun. Mr. Osburn, following the confused system of Champollion Figeac, gives to both the kings the 19 years from 1493 to 1474 B. C., while Manetho gives them not 19, but 68 years; and besides, Mr. Osburn was mistaken by more than 200 years, as we shall see directly.

The question still is, then, in what time the said Pharaohs reigned in Egypt, and in what year the deceased was really born; and this date can not be made out exactly but by the planetary configuration observed during his birth-year, which is represented on his last house, the Leeds coffin. (See Pl. X., Nos. I. and II., which is an exact copy of the fac simile given in Mr. Osburn's Memoir.)

The planetary configuration preserved on our coffin is expressed like those on the sarcophagi in the British Museum, Nos. 3 and 23, and many other monuments mentioned above; and, therefore, it will be easy to make out, in what places of the Zodiac the planets stood at that time, at the priest's birth. Nearly all the astronomical images, occurring on the coffin, have already, by the aid of other astronomical inscriptions, been explained in my Egyptian Astronomy and my Corrections of Ancient History*; it will be sufficient to remember the following rules of Egyptian Astronomy:

1. The 7 planets, inclusive of the Sun and Moon, were expressed by the images and the names of the 7 Egyptian Cabiri, the supreme deities, Osiris, Isis, and so on.

2. The 12 Signs of the Zodiac, the so-called 12 houses of the planets, were represented according to their regular order, by means of the images and names of the 12 great Egyptian deities.

3. The row of the 12 great gods usually was twice expressed, once on each of the longer sides of the sarcophagi, for the purpose of specifying the places of those planets which occasionally occupied the same signs (houses) or smaller parts (Decuriæ, Horia, Dodecatemoria) of the Zodiac.

4. The images of the Zodiacal deities were distinguished

† Systema Astronomiæ Ægyptiacæ quadripartitum, cet. Lips., 1833. Vol. IV.: Lexicon astronomico-hieroglyphicum, cum permultis figuris hieroglyphicis impressis. Berichtigungen der alten Geschichte und Zeitrechnung, cet. Lip., 1855, page 137.

from those of the planetary gods by means of a bushel-measure (in Coptic *bat*), put upon the heads of the Œcodespotæ, expressing the Coptic *abet*, house; which was necessary, because some images and names, given to some presidents of the Signs or houses, corresponded with those of certain planets, being the Œcodespotæ, or presidents of those same Signs.

5. The place of a planet or two in a certain Sign was indicated by putting the image and the name of the planet in the place of the image of the Œcodespota, which was then omitted.

6. In case two or more planets stood in the same Sign, it was customary to specify the Decuriæ, and even the Horia, within the limits of which the two or three planets, being in conjunction, appeared; and therefore they put that planet, particularly on the left side of a sarcophgus, in the house of a planet, viz., that which was the warden of the Decuria occupied by the planet. Supposing, e. g., the Moon and Sun stood in Sagittarius—the former, however, there in the Decuria of the planet Mars,—then the image of the Moon was not only put in the Sign of Sagittarius, but also in a house of Mars. The reason of this curious practice was, that the astronomers intended to show what influence a certain planet would exert as well in a certain Sign, as in a certain Decuria, presided over by another planet. For, it was believed that the original influence of a planet was equally modified while he stood in the house, or in the Decuria, of the same planet.

7. The planets, moving from West to East, were represented looking or walking, in the direction of the Œcodespotæ: while the retrograde planets, i. e., moving from East to West, were represented facing in the opposite direction of the other deities.

8. All sarcophagi and Mummy-Coffins, representing a planetary configuration, contain the house of the Sun, where the head of the Mummy lay; the house of the Moon on the opposite side; and the other 10 Signs according to their regular order, on each side to the right and left of the Mummy.

9. The Egyptian, Greek, and Roman Nativities have reference to one of the four Cardinal days previous to the birth, some to the day of the vernal or autumnal equinox, some to that of the summer or winter solstice. The reason of this practice seems to be, that the astronomers constantly observed the positions of the 7 planets on those days with which a new season, called also a year, began, in order to predetermine the lucky or unhappy nature of the beginning year; then they recorded this planetary configuration in the sacred annals, and represented it on the coffins of all persons born, during that same quarter of a year, and influenced by the same planetary configuration.

Remembering these rules and the specific results obtained from the other astronomical monuments already explained, any one will readily understand this new astronomical inscription.

First, everybody recognizes, on both sides of the coffin (Pl. X., Nos. I. & II.), the said houses of the planets, the 12 Signs of the Zodiac. For, on each side are represented 10 Egyptian buildings with their roofs, to which, in both cases, are to be numbered the two squares at the foot and the head of the coffin, the said houses of the Sun and the Moon; and each of these houses contains the image of its Œcodespota, or that of a planet standing, at that time, in the respective sign. These planetary houses are exactly thus depicted in the old sacred records of Egypt, e. g., in Lepsius' Todtenbuch, Pl. LXI.—LXVII.

Further, every one sees that in the row II. four divinities, equally drawn, bear that *bath*, the bushel-measure, upon their heads, which, as we have seen, served in other monuments to express the houses (*abet*) of the planets, or the Zodiacal Signs, viz., Nos. 6, 9, 10, 11. Consequently, the other divinities in the other houses or Signs represent the planets, viz., in Nos. 2, 3, 4, 5, 7, 8; the said four Signs only were not occupied by a planet. Of these planets the only one in the house No. 3 was retrograde, because it faces in the opposite direction. As for the divinities in the row I., Mr. Osburn failed to copy their images from No. 6 to 11; his Plates show only that the planets Nos. 2, 3, 4 and 5 were in the same houses in which they appear in the row II.

The question is now, first, what Signs or houses of the planets are expressed by the single divinities standing in certain houses; which question is answered by the names and insignia of the 12 Great Gods, or Œcodespotæ, recorded in the single houses, which are already known from other astronomical inscriptions, and from Greek and Roman authorities, as my Astronomia Ægyptiaca shows.

No. 1. As the square on the head always contains the Œcodespota of the Sun-house, the Virgo, and as Isis sometimes signifies the female Sun, this deity, represented in No. 1, expresses the house of the Sun, the Virgo. The joined legend contains the following words: *Eshi masi, kore-t, amoni htor, heri hur-t pe mesh toto kab* (i. e., Isis, genitrix valida, nutrix divina, veneranda domina plenitudinis terrarum); which predicates clearly notice the Sun-god, the Œcodespota of the Sign Virgo. By means of the additional four well known Genii, the lords of the four seasons, it is indicated, at the same time, that the Sun-god was the governor of the four seasons of the year.

The Signs next to Virgo are Libra, Scorpio, Sagittarius, Capricornus (Nos. 2, 3, 4, 5), which, as we have seen, do not contain their Œcodespotæ, but the images of certain planets.

No. 6. This Œcodespota, distinguished by the said bath-measure, is called *Neith, kor-t masi, kor mas-t hetor-wi;* i. e., Neith, cœlestis genitrix, valida mater deorum ; in one word, Venus Urania, as the Greek and Latin authors translate. This goddess was a female personification of Saturn, the Œcodespata of Aquarius, and consequently no planet stood at that time in Aquarius.

The Signs following Aquarius are Pisces and Aries, in which we find two planetary gods.

No. 9 contains the title of the Œcodespota of Taurus, viz., *Neith masi, kor amoni-t htor* (viz., Neitha genitrix, valida nutrix divina); consequently this Neith differed from that Venus Urania; she was a female personification of Mars, the Œcodespota of Taurus, as is known from other astronomical inscriptions.

No. 10. The Gemini, following Taurus, are expressed by the Egyptian goddess Selk, whose title is *Selk, kel-hoite-t kor kob;* i. e., Selk, textrix vestium, domina texturæ. The name Selk itself is related to *kle* and *sle*, the scorpion, and Venus presided also over the sign Scorpio, as we have seen.

No. 11. Cancer, the House of Mercury, is expressed by the Œcodespota Nepti, a known female personification of Mercury, mentioned also by the Greek authors ; whose title is *Nept masi, hetor sont ker;* i. e., Nephthis genitrix, divina soror Uraniæ.

The square at the foot of the mummy, which always represents the house of the Moon, does not contain the image or name of its Œcodespota, but the symbol of a planet, as we shall see directly, adored by Isis and Nephthys.

Thus, then, the 12 Signs of the Zodiac were, on the coffin, arranged as follows :

SIGNS.			ŒCODESPOTÆ.			PLANETS.
1. Virgo,	♍	......	Isis,	☉	....	——
2. Libra,	♎	......	———	☿	....	♂ ♀
3. Scorpio,	♏	......	———	♀	....	☿
4. Sagittarius,	♐	......	———	♂	....	☉ ☽ ♀
5. Capricornus,	♑	......	———	♃	....	♄
6. Aquarius,	♒	......	Neith Kor,	♄	....	——
7. Pisces,	♓	......	———	♄	....	♀
8. Aries,	♈	......	———	♃	....	☽
9. Taurus,	♉	......	Neith,	♂	....	——
10. Gemini,	♊	......	Selk,	♀	....	——
11. Cancer,	♋	......	Nephthys,	☿	....	——
12. Leo,	♌	......	———	☾	....	♃

On the other side of the coffin (row I.) occur some other names of the same deities, which were partly equivalent ones, and partly served to specify the position of certain planets, as we shall see. Thus, e. g., the Œcodespota of Cancer (No. 11 of the row I.), viz. Mercury, is called Anubis, which is a well known name of Mercury; the Œcodespota of Pisces (row I., No. 7) is called *Mashi* (Nemesis), which is a common name for the female Saturn.

Finally, the question is, what planets stood in those Houses or Signs, in which the Œcodespotæ are supplied by the images of certain planets?

No. 4. First, the place of the Sun is easy to be recognized; for, on both sides of the coffin, Osiris (the well known Sun-god) and his names are put in Sagittarius. This deity, ornamented by his solar disk, crown, whip, and scepter, is called on one side, *osh heri-ham, nat mesh tho, wen nufi, neb keet tneu*—i. e., Osiris venerandus, textor plenitudinis terræ, bonus spiritus, princeps perennis; in the other row, *hr, hr tene tene, ham*—i. e., Horus, the lord of both the spheres, the creator. Thus, then, the Sun stood, at that time, in Sagittarius, the house of Mars, as we have seen, viz., in its first degree: for the place of the winter solstice was always between the eastern and western house of Saturn—i. e., the signs Aquarius and Pisces (Nos. 6 & 7),—and all the planetary configurations were observed on a Cardinal day; consequently, the Sun, being put in the 3d house or sign west from the winter solstice, was, at that time, in contact with the first degree of the Sign Sagittarius, i. e., on the place of the autumnal equinox.

No. 4. The place of the Moon is equally easy to be made out; for, Isis, ornamented with the throne—pronounced *isi*, and accompanied by the legend, *Eshi mas, amoni hetor*, i. e., Isis genitrix, nutrix divina—is the most common image of the Moon; and she also is put in Sagittarius. Besides, that other Isis, the Œcodespota of Virgo (No. 1), is distinguished from the lunar Isis in Sagittarius by different titles. In the row I. we find, instead of this Isis, the goddess *Mashi mashi*—i. e., Justitia judicans—ornamented with the ostrich feather, expressing the same word *Mashi*, Justicia; and this deity refers also to the Moon, particularly to the new moon, like the Hecate of the Greeks and Romans.

No. 4. The planet Venus, whose greatest elongation from the Sun amounts but to 48 degrees, is also put in the said house of Mars, and represented there by the sparrow-hawk, the most common symbol of the planet Venus, viz., for want of room, by its head in the roof of the house Sagittarius. Consequently, Venus stood at that time in the Sign Sagittarius together with the Moon and the Sun; wherefore her place and that of the Moon were to be determined more distinctly in other places, as we shall see hereafter.

No. 3. The planet Mercury, in the house of Venus (Scorpio), is expressed by its most common symbol, the god Thoth, the well known Egyptian Mercury. He is represented with the head of Ibis, holding a papyrus-scroll, and a scepter bearing the image of the starry heavens, because Thoth is said to have been the inventor of Geometry, Astronomy, and the art of writing. The subjoined legend contains the words *Thoth, mone toto, nubt htor tout-wi kom-skai;* i. e., Thoth, pastor terrarum, inventor divinarum imaginum scripturæ. As he is represented in the opposite direction in the house of Venus, the planet Mercury was, at that time, retrograde in the Sign Scorpio; and thus the position of the Sun in Sagittarius is confirmed, because Mercury's distance from the Sun never amounts to more than 29 degrees.

No. 5. The Sign Capricornus, the house of Jupiter, contains, on both sides, the well known image of the planet Saturn; for he was, in Egypt, called *Seb*—i. e., χρωνος, Saturnus,—and distinguished by two ostrich feathers and the following title, *Seb, esh pot shot-eut htor, htor, htor;* i. e., Saturnus, persecutor deorum. The same is said of the god Typhon, i. e., Adversarius, which was a characteristic surname of Saturn.

No. 12. In the house of the Moon, the Sign Leo, we find a fourfold altar, expressing in other monuments the planet Jupiter. (See my Astronomia Ægypt., p. 399, No. 607.) That hieroglyphic figure, sounding *tate*, expresses the god Tatis, mentioned by Manetho; which name, derived from the Coptic root *taate* (splendere), characterizes Jupiter, the very splendid planet. For the rest, Jupiter stands between the said deities, Isis and Nephthys, adoring them, probably because this planet appeared then upon the limits of two zodiacal segments in Leo belonging to Isis and Nephthys, i. e., to the Sun and Mercury: for Isis, as we have seen, was the Œcodespota of Virgo, the Sun-house; and Nephthys, bearing also her name upon her head, signified (row II., No. 11) the Œcodespota of Cancer, the house of Mercury. Consequently, the planet Jupiter, at that time, stood in the house of the Moon, the sign Leo, or, more distinctly, upon the boundary of the two zodiacal segments of Leo, belonging the one to Mercury, and the other to the Sun, as we shall see hereafter.

No. 2. This house of Mercury, the Sign Libra, contains the well known image of the planet Mars, the last of the seven planets to be mentioned, viz., the Egyptian Ptah; for this deity, represented in the shape of a mummy holding a sceptre, the so called crux ansata, the fourfold table, a whip, and the crook, which syllabically express the character and qualities of this planetary god, is accompanied by the name *Ptah Sokari*, and expresses, on innumerable monuments, the planet Mars.

Thus, then, the planetary configuration represented on the Leeds mummy-coffin is the following:

Saturn (Seb) in the House of	Jupiter,	i. e.,	Capricornus.
Jupiter (Tatis) " "	the Moon,	"	Leo.
Mars (Ptah) " "	Mercury,	"	Libra.
The Sun (Osiris) " "	Mars,	"	Sagittarius.
Venus (Isis) " "	Mars,	"	Sagittarius.
Mercury (Thoth, retrog.) "	Venus,	"	Scorpio.
The Moon (Isis Amoni) "	Mars,	"	Sagittarius.

The date of this planetary configuration is determined by the places of Saturn, Jupiter, Mars, and the Sun alone, and there is no need of concerning ourselves about the places of Mercury, Venus, and the Moon; for there are not two autumnal equinoctial days in all ancient history on which a similar planetary configuration, abstractly from the so called inferior planets, had occurred, as we shall see hereafter. As, however, the places of Venus, Mercury, and the Moon must confirm the date in question, and as the inscription contains some other planetary figures—viz., in row I., Nos. 2 & 6, and in row II., Nos. 2, 7 & 8—not yet spoken of, the question is, what do they mean?

As the ancient astronomers used to specify the smaller parts of the Zodiac occupied by those planets which were in conjunction with others, and as Venus and the Moon together with the Sun stood in Sagittarius, the planetary images in question must refer to the Decuriæ and Horia in the Sign of Sagittarius, within the limits of which the respective planets appeared. Those Decuriæ, Horia, and so on, were also presided over by the planets according to their natural succession; and the first Decuria together with the first Horion of the Zodiac, and so on, began with the place of the vernal equinox; consequently, with the original house of Mars, the sign of Taurus. It is for that reason Ovid sings, "Aperit Taurus cum cornibus annum." The whole series of the Egyptian Dicuriæ, Horia, and so on, with their planetary wardens, is depicted in the first Plate of my Astronomia Ægyptiaca.

Finally, recollect that the Egyptian astronomers used, on monuments of this kind, to put the planet standing, e. g., in the Decuria of Mercury, in one of Mercury's houses. Commonly, the astronomers agreed in mentioning the Decuria occupied by a certain planet; sometimes, however, they mentioned also the Horion, and even the Dodecatemorion and the degree; which was the case when two planets occupied the same Decuria or Horion, or when a planet stood in that Decuria which he presided over himself; for, in this case, the supposed influence of the planet was not modified by the supposed influence of the equal planetary warden.

The Sign of Sagittarius, i. e., the Sign East from the point of the autumnal equinox, contained the following Decuriæ and Horia:

<table>
<tr><th></th><th>0–28</th><th>28–21</th><th>21–20</th><th>20–14</th><th>14–10</th><th>10–6</th><th>6–0</th></tr>
<tr><td>Dec.</td><td colspan="3">Jupiter</td><td colspan="2">Saturn</td><td colspan="2">Mars</td></tr>
<tr><td>Hor.</td><td>♑</td><td>♀</td><td colspan="2">♃</td><td colspan="2">☿</td><td>♄</td></tr>
<tr><td>Plan.</td><td></td><td></td><td colspan="2">☽</td><td colspan="2">♀</td><td>☉</td></tr>
</table>

As, then, both the Moon and the Sun stood at that time in Sagittarius, and as the Egyptians used to specify the places of the inferior planets by mentioning in what Decuria and Horion they also stood, and by putting the planet in that planetary house which belonged to the same planet which was the president of the respective Decuria or Horion, the next question is, in what Decuria or Horion of Sagittarius the Moon stood at that time. Indeed, our inscription contains three deities representing the Moon, viz., in Sagittarius, where the Moon was in conjunction with the Sun, further in the house of Jupiter (row II., No. 8), and finally in the house of Saturn (row I., No. 6); for that Thoth, with the head of Ibis and the crescent upon it, accompanied by the title, *Thoth, mone towe, neb zor*—i. e., Thoth pascens terras, regina cœli,—is a well known lunar deity, differing from the Thoth-Mercury: because the Egyptians, as Cicero and others relate, had many Thoths, and that Thoth, in No. 3, representing Mercury, is distinguished by other insignia and titles.

Finally, the house of Saturn (row I., No. 6), although Mr. Osburn neglected to copy the likeness of the deity occupying this house, contains the name of another well known lunar goddess, namely, *Tore;* always expressed by the hieroglyphics, beetle (*t*), mouth (*r*), and leaf (*e*). As, then, the Moon, being in Sagittarius, stood at the same time in two zodiacal segments belonging the one to Jupiter, the other to Saturn, she must have been observed in the Decuria of Saturn and the Horion of Jupiter, or vice versa, in the Decuria of Jupiter and the Horion of Saturn, viz., in Sagittarius. Now, Sagittarius, as the scheme shows, contained both a Decuria of Saturn and a Decuria of Jupiter; but the latter did not contain a Horion of Saturn, while the Decuria of Saturn, extending from 10 to 20 degrees, contained a Horion of Jupiter extending from 14 to 21 degrees. Consequently, the Moon, at the time of the observation, was in the Decuria of Saturn and in the Horion of Jupiter; in other words, she stood between the degrees 14 and 20 of Sagittarius, the house of Mars.

Libra. The places of the planets, thus reduced, are indicated in the foregoing scheme, and put in crotchets [ ].

The following is a calculation of the said planetary configuration according to Lalande's Planetary Tables, not an exact, but an approximative one, because the latter is sufficient for the purpose, and because a more accurate calculation would have produced a difference, perhaps, of but two or three degrees. Only the place of the Moon, on which, as we shall see, depends the correction of the usual Tables of the Moon, is more exactly calculated. The date in question is this:

Julian year 1722 *B. C., October 7th*, 6*h. P.T.*

ANCIENT OBSERVATION.		HELIOCENTR.	GEOCENTR.
Saturn in ····♏	0°—30°	♏ 27° 44′	♏ 20°
Jupiter······♋	7° 30′	♋ 1° 41′	♋ 12°
Mars·······♌	0°—30°	♌ 7° 20′	♌ 27°
Sun··········♎	0° 0′	....	♎ 0° (5s. 29° 27′)
Venus ······♎	10°—14°	♎ 26° 22′	♎ 11°
Mercury···· ♍	0°—30° (ret.)	♊ 12° 54′	♍ 6° (retrg.)
Moon······· ♎	14°—20°	....	♎ 26°

All the places of the planets observed 1722 B. C., as it is obvious, harmonize with the calculation except those of Jupiter and the Moon, of which the longitudes were a few degrees shorter, according to the Ancients; and this discrepancy shall be discussed hereafter. Even the retrograde motion of Mercury agrees with the Tables; for it is known that Mercury being heliocentric in Gemini 12° 54′, while the Sun stood in Libra 0°, must appear retrograde to human eyes.

Perhaps, however, one would object that the said planetary configuration may have occurred not only in 1722 B. C., but also in a later or former year. This objection, however, is easy to be removed; for, as the Sun was in Libra 0°, and Jupiter in Cancer 7° 30′, these positions of Jupiter and the Sun, as every astronomer knows, can not return till after 83, or rather 166, or, more exactly, after 249 years, Julian style; consequently, not twice in the age of the whole XVIIIth Dyn. till Osimanpta and Ramses Meiamun. Further, Saturn does not, on the same day, return to a degree occupied formerly on the day of the autumnal equinox till after 206 years; Mars can not again, on the same day, occupy the same degree of a Sign till after 205 years; and the Moon being at that time in Libra 14°—20°, is not again in conjunction with the Sun standing in Libra 0° till after 19 years. Consequently, a similar planetary configuration occurs only once in 249×206×205×19 years, i. e., in a period of many millions of years; and taking into consideration the position of Venus and Mercury, we would have several millions more. And with this law of astronomy the Ancients were already well acquainted;

for Proclus (Lib. I., chap. 2, p. 10) says: "omnium cœlestium et terrestrium restitutionem vel nunquam ad amussim accidunt, aut certe non iis spatiis, quæ comprehendere homines possunt." The translator of Tabari's chronicle, mentioning the planetary configuration of the year 5870 B. C., adds: "this was the beginning of the world, and since that time the planets have never again been in the same position." It is true that after 2146 years similar planetary configurations return, but the longitude of some planets is then very different; and 2146 years before 1722, i. e., 3868 B. C. (viz., 422 years before the Deluge), or 2146 years after 1722, i. e., 424 A. C., in the time of Theodosius, no Egyptian Pharaoh called Osimanpta or Ramses, was reigning.

Thus, then, the result that the priest in the Leeds coffin, a cotemporary of the great Sesostris, the builder of the world-renowned Osimandyeum at Thebes, was born in 1722 B.C., will, I hope, remain fixed for all time.

Finally, it will be asked, what benefit can we gather from such old rubbish? Let us see.

1. The Leeds mummy-coffin confirms the key to the astronomical monuments of the Egyptians, Greeks, and Romans. It is possible that my Astronomia Ægyptiaca still contains many defects, but the principles upon which it is founded can not be fallacious; for, supposing I had there referred wrong Cabiri to the planets, and wrong deities to the Signs, Decuriæ, and Horia of the Zodiac—that I had applied a wrong method of explaining the astronomical minutes of the ancient nations,—the present inscription, surely, would never have yielded a planetary configuration harmonizing with its particulars and with Egyptian history. Mr. Osburn's Memoir first came into my hands a few months ago; notwithstanding, the deities, expressing the planets and the zodiacal segments on the coffin, were correctly predetermined in my Egyptian Astronomy. The key to the astronomical monuments of all the ancient nations is now accessible to everybody, and this fact, no doubt, will be useful in many respects; for there probably still exist many hundred astronomical inscriptions of that kind, preserved on Egyptian pyramids, temple walls, catacombs, on the sarcophagi, coffins, and papyrus-scrolls, in the Egyptian museums, and further, on the Greek and Roman temples, altars, sepulcral monuments, vases, and so on, reaching from 2780 B. C. down to 500 A. C.; and I am convinced also that the Assyrian, Babylonian, Indian, Chinese, Mexican, and similar antiquities contain similar planetary configurations. By the aid of so many astronomical monuments, it will be possible to rectify, more and more, Egyptian history and chronology, which, during so many centuries, were enveloped in impene-

trable darkness and irreconcilable contradictions, and to illustrate those of other nations. As in former times no astronomical observations prior to the time of Ptolemy (130 A. C.) were known, and as those of the Egyptians refer to quite older times and even to that of Menes (2780 B. C.), it is obvious that such numerous and ancient observations must serve to rectify our planetary Tables, based upon Ptolemy, and the present theory of our solar system in general. Besides, those astronomical inscriptions, as we have seen, are so simple and plain, that every one, being acquainted with the elements of astronomy, is enabled to understand and explain them.

2. The Leeds coffin proves again that astronomy is as old as human society, as Josephus, Aristotle, Cicero, Diodorus, Egyptian papyri, and other authors, testify. Formerly, it was believed and taught that no Zodiac existed before the year 500 B. C.; but here we see that the Egyptians, in 1722 B. C., were already familiar with the smallest segments of the Zodiac; that they already understood the art of determining the places of the planets to a nicety; that they knew the motion of the equinoctial points. Now, how many centuries, prior to 1722 B. C., must have elapsed before astronomy attained to so high a degree of perfection? Therefore nobody has a right to despise and reject the planetary configuration observed at the end of the Deluge in 3446 B. C., at the beginning of the second age of the world in 3724 B. C., and that at the commencement of its first age in the year 5870 B. C.

3. The Leeds coffin also confirms the key to the whole mythology and history of religion among the ancient nations, which, for more than 300 years, was a very chaos; for nobody was able to say what objects were really adored and personified by the Egyptians, Canaanites, Assyrians, Greeks, Romans, Persians, Scandinavians, Indians, Chinese, Mexicans, and others; why they worshipped 7 Cabiri, 12 Great Gods, 36 inferior deities; why they distinguished them by certain animals and peculiar ornaments. According to the *historical* system, all the deities of the Ancients were eminent persons of former times. According to the principles of *natural philosophy*, these deities signified natural powers, as fire, water, earth, light, darkness, storms, thunder and lightning, heat, cold, hail, and so on. From the *chemical* principle it was deduced that the same deities represented certain chemical potencies, as different acidities and alkalies. The author of the *chronological* principle pretended that these same deities were symbols of diffferent shorter or longer periods, as days, seasons, years, septennia, centuries, milleniums, etc. The *fetish* principle made out that the most ancient human race, being not very different from the orang-outang, adored but fetishes—i. e., in-

ferior objects of nature, as trees, plants, pieces of wood, serpents, and so on—in which, as they supposed, magical forces resided. By and by, however, when human reason had made some progress, these magical powers were abstracted and advanced to the rank of peculiar deities. The adherents of the *astronomical* principle pretended that the ancient deities were but the planets and the innumerable constellations of heaven; nothing else. According to the *metaphysical* principle, these gods represented different ideas of metaphysics, as strength, justice, wisdom, fidelity, honesty, bravery, virtue, and the like. The advocates of the *political* principle maintained that the ancient deities were mere phantoms, excogitated by the priests for the purpose of restraining the anarchic and refractory people. According to the *moral* principle, these different godheads were created by benevolent persons in order to establish moral ideals, and to induce the people to conform their conduct to these moral patterns. At present, in consequence of the *geographical* principle, it is universally taught that each nation adored deified powers of nature visible in its own country, as rivers, lakes, mountains, valleys, volcanoes, seas, and similar objects. Finally, many ancient authors, as Cicero, Aristotle, Seneca, Maximus Tyrius, and others, testify that the ancient deities, in the first stage, were representations or symbols of Divine qualities, viz., of the omnipotence, wisdom, magnificence, bounty, justice, inscrutability of the Creator, and so on.* In the second stage, the philosopher separated these divine qualities from the Creator, and changed them into peculiar higher beings, created by the Lord, which, as the sacred records of the Egyptians say, "work for their master and for his glory," to which he had committed the work of creation and the government of the world; of which, finally, the bodies were the 7 planets and the different constellations of the Zodiac. At the same time, all objects of the world were divided, according to the true or imaginary natures of the planetary gods, into 7 classes, and over each class, or ducatus, one of the planets presided; from which classes the insignia and symbols and ornaments

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* Seneca (IV. 7, 8) says: you may call the Creator of all things by different names, as Tonitrans, Conservator, Fatum, which may be as numerous as the *manifestations* of his power, Liber, Hercules, Mercurius, they are but different names of the same divine being, referring to its different qualities. Porphyr. De Abstin. IV. 9: Ægyptii per nomorum suorum animalia venerabantur Dei in res omnes potentiam, quam singuli deorum declarant. Cicero N. D. I. 10: Mundus est Deus, quoniam partes mundi sunt Dei membra.

of the single deities were chosen.† Some of the 7 planets and the 12 Great Gods were called by similar names and represented by similar images, because the planets were the presidents of all the segments of the Zodiac. These and other particulars are confirmed again by the astronomical inscription on the Leeds mummy-coffin. In short, then, the deities of the ancients were, in higher respects, God's ministers or angels—in later times, spirits—residing in the planets and constellations, and in their own creatures.

4. The Leeds coffin, being to-day nearly 3520 years old, confirms, by a new and mathematical proof, the true history and chronology of the Egyptians, and confutes many a celebrated book; for it is known that for 400 years innumerable attempts were made in order to determine the time of the single Egyptian dynasties, and that in consequence of the corrupted figures in the Vetus Chronicon, Josephus, Africanus, Eusebius, the Armenian Eusebius, Syncellus, and others, not one of them corresponds with the other.‡ Regarding the XVIIIth Dyn., we find differences of many hundred years in the works of Ameilhon, Perizonius, Savigny, Bovet, Mure, Champollion Figeac, Rosellini, Crothwaite, Archinard, Henry, Felix, Leseur, Sharpe, Barucchi, Maury, Rask, Vaucelle, Bunsen, Lepsius, and others. Mr. Osburn himself ascribes to the Pharaoh Ramses Meiamun, the last king of the XVIIIth Dyn., the period from 1493 to 1473 B. C. In 1833, however, the nativity of this same Ramses, represented on his magnificent granite sarcophagus in the Louvre, and some years after, the nativity of Ramses' father and predecessor, Osimanpta, represented on the costly alabaster sarcophagus in Saone's Museum at London, came to light; and what was now the time of the combined government of Osimanpta and Ramses? The latter was born in 1693, the former in 1730 B. C.; consequently, they reigned at least 200 years before the time fixed by Mr. Osburn and Champollion. With reference to the nativity of the successor of Ramses Meiamun, called Sethos, the first king of the XIXth Dyn., preserved on his grand sarcophagus in the British Museum—which nativity, as I also showed, in 1833, in my Egyptian Astronomy, refers to the

† Cicero N. D. I. 13: Sunt dii octo, quinque qui in vagis stellis (planetis) nominantur, unus (mundus), qui ex omnibus sideribus, quæ infixa cœlo sunt, ex diversis quasi membris, simplex sit putandus deus, septimus Sol, octavus Luna. Clemens Al. Protr., p. 44: Septem sunt dii planetæ, octavus vero, qui ex his omnibus constat, mundus.

‡ Of the same kind is the very large work of Mr. Lepsius, recently published, entitled the "Koenigsbuch der alten Ægypter." I have examined it, and seen that, from Menes down to Titus, it does not contain a single true date.

year 1631 B. C.,—the governments of the said kings were fixed thus:

1780 B. C. Osimanpta born.
1693 " Ramses Meiamun born.
1692 " Osimanpta still governs alone.
1691 " Ramses M. governs together with his father.
1631 " Sethos, the first king of the XIXth Dynasty, born.
1606 " Ramses Meiamun dies.

At present, the Leeds Nativity says to us that the deceased, being a contemporary of Osimanpta and Ramses, was born in 1722 B. C., i. e., 8 years after Osimanpta, and 29 years before Ramses; consequently the said Pharaohs, indeed, must have governed from 1691 to 1606 B. C. Further, as Ramses died in 1606 B. C., and as from Amos I., the first king of the XVIIIth Dyn., down to the expiration of the XVIIIth Dynasty, 298 years elapsed, the government of this Dynasty must have begun 1904 B. C., which date is confirmed by the transit of Mercury, and the renewal of a Phœnix-period of 651 years, during the government of Amos I. Finally, as, according to Eratosthenes, the Tables of Karnak and Abydos, and the Vetus Chronicon, Menes reigned 1175 years previously to Ramses' death in 1606, the Egyptian empire must have begun in 2781 B. C., together with the first Canicular Period; which date is supported historically by Herodotus and the Vetus Chronicon, mathematically by the Nativity of the Egyptian empire, represented on sixteen monuments, and referring to the year 2781 B. C. For a chronologer, who had fixed the times of Ramses, Amos I., and Menes, very differently from all his predecessors, nothing could be more comforting than to meet with an astronomical monument verifying his chronological statements, many years after, with mathematical certainty.

5. The same astronomical inscription confirms also the true Biblical history and chronology. For, in consequence of the passage 1 Kings 6, 1, according to which, not 880 but 480 years, or, as the Septugint reads, 440 years only elapsed from the Exodus to the building of Solomon's temple, all the Biblical Chronologies now in vogue put the dispersion of the nations, the deluge, the creation, 400 years too late. The Book of Judges, the genealogies in the Old Testament, and Josephus, however, testify that 880 years intervened between the Exodus and Solomon's temple, and that is what our inscription also confirms. For, the Fathers of the Church relate that the Israelites left Egypt under Amos, the first king of the XVIIIth Dyn., and in Exod. 1, 8, we read: "There arose up a new king over Egypt, which knew not Joseph," i. e., not the son of the preceding king, but the first king of a

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new, viz., the XVIIIth Dynasty. As, then, this Dynasty, down to Ramses' death, in 1606 B. C., governed during 298 years, its first king, Amos, must have been upon the throne about 1904 B. C.; consequently, the Israelites left Egypt, not, as is universally supposed, in 1500 B. C., but 400 years earlier, exactly in 1867 B. C., as follows from the detailed Biblical biography and the remarkable conjunction of Saturn and Jupiter in Pisces in 1951 B. C., three years previous to the birth of Moses; which phenomenon is mentioned by Josephus and the Rabbis. As, then, the Exodus happened 400 years before its formerly fixed year, it is obvious that all the preceding Biblical epochs are to be put earlier by 400 years, as the planetary configurations, referring to the deluge and the ages of the world, confirm. This matter has been treated *in extenso* in my Chronologia Sacra and the Summary of Recent Discoveries.

6. The same planetary configuration gives another instance of the necessity of correcting the usual planetary tables. The longitude of Jupiter in Cancer is, according to Lalande's Tables, as we have seen, too great by four degrees; as my calculation, however, is not exact, and the perturbations of Jupiter sometimes are considerable, I drop the investigation concerning this planet. As to the Moon, however, it is obvious that the said excess of at least 6 degrees materially affects our Tables. The Egyptian astronomers, having proved themselves, as many other monuments show, able to determine the places of the planets to the nicety of half a degree, could not have committed a mistake of 6 degrees, or 12 diameters of the full Moon; and, since very important modifications of a beginning year depended, according to their belief, on the position of the god of the Moon, at its nativity, they would not have carelessly placed the Moon in two totally wrong planetary departments. Besides, the time of that observation, viz., about sunset, is equally sure. For, as the Moon stood only 20 degrees East from the Sun, her setting took place one hour and twenty minutes after that of the Sun, the parallax neglected; consequently, the Moon remained invisible the whole subsequent night, and the next following evening the Moon stood in another Sign, 13° E. from her former place, and not "in the same house with the Sun." Thus, the only possibility left is, that our Lunar Tables are incorrect; and this assertion, though bold, is verified as well by the known carelessness of Ptolemy, the real originator of all the subsequent Lunar Tables, as by the total eclipse of the Sun observed in 1851 in Europe, and by a great multitude of solar and lunar eclipses observed by the Ancients.

First, Ptolemy (130 A. C.), in his Almagest, mentions 19

eclipses of the Moon, inclusive of 7 old Babylonian ones, connected with certain years of certain kings, and, regarding their time and dimension, calculated by himself to minutes*; in doing so, however, he had the misfortune of following the very incorrect chronological tables already in use in his days. The oldest eclipse, that in the first year of Mardokempad, e. g., occurred not in 720 but in 721 B. C., and also all the others in other years; thus, Ptolemy could not but incorrectly determine the said mean motion of the Moon, the lunar nodes, and so on. All subsequent authors of Lunar Tables relied upon Ptolemy's calculations, but never succeeded in constructing exact Tables. A few years after new Tables had been constructed, it became apparent that they did not correspond with the latest observations, on account of Ptolemy's theory being wrong. The same must be said of the celebrated Tables of Burckhardt and those of Damoiseau; for, on occasion of the total eclipse in 1851, it was brought to light that the Moon was again 57 seconds slower than these, our best Tables, with Airy's corrections, had determined. The longitude of the Moon was 37 seconds shorter than that obtained by the Tables. The same is proved by 28 ancient eclipses, the more so the older they are. Thus, e. g., that authenticated solar eclipse which was seen in Rome in 752 B. C., May 25, 16h. Par. time, took place, according to the modern tables, at least 2h. 40m. before sunrise; consequently, the mean motion of the Moon, as determined by Ptolemy, and adopted in all subsequent tables, must be too great. The total eclipse of the Moon observed at Babylon, in 721 B. C., Sept. 23, 1h. 40m. P. T., took place, according to our Tables, at least 1h. 30m. before sunset. The total eclipse of the Sun observed at Rome, in 642 B. C., Jan. 11, 18h. P. T., preceded sunrise nearly 2h. 50m. The total eclipse of the Sun seen on the Halys, 36° E. from Paris, viz., in 581 B. C., Mar. 27, 17h. 45m. P. T., preceded sunrise at least 40m. That total eclipse of the Sun observed near Smyrna in 478 B. C., Feb. 27, 15h. 30m., preceded sunrise nearly 2h. 50m. The nearly total eclipse of the Sun observed at Athens in the afternoon, as Thucydides testifies, in 429 B. C., Jan. 26, 22h., must have taken place 2h. 30m. later. To these may be added more than twenty similar eclipses, which concur in proving that the secular mean motion of the Moon, adopted in all Lunar Tables down to this day, is somewhat too great.

The present astronomers, forced by the before-mentioned solar eclipse in 1851, have, indeed, already attempted to rec-

* See Goettingische gelehrte Anzeigen, 1855, No. 125, pp. 1241—'75.

oncile Burckhardt's and Damoiseau's Tables with the heavens, not by diminishing the supposed secular mean motion of the Moon, but by changing its supposed anomaly. This proceeding, however, is in conflict with our Egyptian astronomer, and with 28 of the ancient eclipses specified in the chronological Tables appended to my Summary; according to which, the adopted mean motion of the Moon is to be diminished before all. The modern theory of the Moon supposes the Moon to move, in 100 years, 9 signs, 7 degrees, 53 minutes, and 10 seconds; but, in 1722 B. C., the place of the Moon was at least 6 degrees West from the point fixed according to the said secular mean motion of the Moon; i. e., the Moon did not reach that place till nearly 12 hours later. It may be granted that the Egyptian astronomers observed the Moon one hour after sunset, while the horizontal parallax took two hours; then the fault of the modern Tables concerning the epoch of 1722 B. C. amounts to 9 hours only. We may further suppose that the half of those 57 seconds, by which the total eclipse in 1851 began too late, equally affects the lunar anomaly, being also based upon Ptolemy's wrong theory, and that accordingly, in 1700 A. C., the Moon reached a place in the Zodiac only 30 seconds later than our Tables say; that, finally, the acceleration of the Moon, like that of the lunar nodes, is equal to the squares of the times. These cases being admitted, I say that, in 1722 B. C., Oct. 7, 7h., the Moon really stood nearly 6 degrees West from the place obtained by the present Tables; consequently, in fact, 19 degrees East from the Sun, as the Egyptian astronomers observed.

And this result agrees perfectly well with the ancient eclipses; for then, e. g., in 752 B. C., the Moon was nearly 5 hours later in conjunction with the Sun, and the eclipse was seen in Rome 2 hours after sunrise. The same holds with the said Roman eclipse in 642 B. C., and all the rest. That famous total eclipse of the Sun, near Smyrna, in 478 B. C., Feb. 27, 15h. 13m., took place not 2 hours 50 minutes before sunrise, but it began with sunrise, as Herodotus relates, and so on.

These calculations are not at all exact, but real astronomers will excuse that; notwithstanding, I take the liberty of calling their attention to an important object, which involves a correct theory of the Moon, and exact Lunar Tables.

Notice of FOSSILS FROM THE PERMIAN STRATA *of Texas and New Mexico, obtained by the United States Expedition under Capt. John Pope for boring Artesian Wells along the 32d Paral., with Descriptions of New Species from these Strata and the Coal Measures of that region.*

BY B. F. SHUMARD, M.D.

PERMIAN FOSSILS.

At the meeting of March 8, 1858, I had the honor of announcing to the Academy the existence of an extensive development of Permian Rocks in the Guadalupe Mountains of Texas and New Mexico. This announcement was based upon a rather hasty examination of a series of fossils collected by my brother, Dr. Geo. G. Shumard, while acting as Geologist of the U. S. Expedition for boring Artesian Wells along the 32d Parallel, under the direction of Capt. John Pope. The present communication embraces the results of a more thorough investigation of this interesting collection of fossils, which Capt. Pope has had the kindness to place in my hands for determination and description. It will be seen that the list contains a number of species that occur in the Permian beds of Kansas, and which have been described in the valuable papers of Messrs. Swallow and Hawn and Messrs. Meek and Hayden. Others are identical with characteristic fossils of the Permian beds of England, Germany, and Russia. But the largest proportion of species are new to science.

I would further observe, that Prof. Marcou, in the map accompanying his late work on the geology of North America*, has colored that portion of the Guadalupe Mountains whence our Permian fossils were obtained as Coal Measures and Lower Carboniferous, and that the rocks described by him as of Permian age do not agree in lithological features with the Guadalupe strata.

ZOOPHYTA.

CHÆTETES MACKROTHII, Geinitz.

Our specimens apparently agree in every particular with the figures and descriptions of this species, as given in the works of Geinitz and King.

Locality.—Dark Limestone of the Guadalupe Mountains.

* Geol. of N. Amer., Zurich, 1858.

CHÆTETES, sp. (?)

Locality.—White Limestone, Guadalupe Mountains.

CAMPOPHYLLUM (?) TEXANUM, n. sp.

This is a long, subcylindrical, flexuous species, having a diameter above of about one-third of an inch. It is covered with a thin epithelium. The interior structure is unknown. I place it provisionally in the above genus until I can have an opportunity of examining better specimens.
Locality.—White Limestone, Guadalupe Mountains.

POLYCŒLIA. (?)

There are several examples of a Cyathophylloid coral which seem to possess the characters of the above genus.
Locality.—Dark Limestone, Guadalupe Mountains.

CRUSTACEA.

PHILLIPSIA PERANNULATA, Shumard, Trans. Acad. Sci., St. Louis, Vol. 1, p. 296, pl. XI., fig. 10.

White Limestone, Guadalupe Mountains, Texas and New Mexico.

BAIRDIA, sp. (?)

This is a very minute species scarcely exceeding one-thirtieth of an inch in length.

White Limestone, Guadalupe Mountains, Texas.

BRYOZOA.

FENESTELLA POPEANA, Prout, Trans. Acad. Sci., St. Louis, Vol. 1, page 229.

White and Dark Limestone, Guadalupe Mountains.

ACANTHOCLADIA AMERICANA, Swallow.

Our fossil seems to be identical with this characteristic species of the Permian system of Kansas.
Gray Limestone, Guadalupe Mountains, Texas and New Mexico.

FORAMINIFERA.

FUSULINA ELONGATA, Shumard, Trans. Acad. Sci., St. Louis, Vol. 1, page 297.

White Limestone and underlying Sandstone, Guadalupe Mountains, Texas and New Mexico.

BRACHIOPODA.

Genus Productus.

P. Calhounianus, Swallow, Trans. Acad. Sci., St. Louis, Vol. 1, p. 181.

The collection contains two specimens, which I refer to this species, one of them from the White Limestone and the other from the underlying Dark Limestone of the Guadalupe Mountains. They are both somewhat imperfect in the cardinal region, but after a careful comparison of authentic specimens of *P. Calhounianus* from Kansas, I am unable to find any marked specific difference.

P. Mexicanus, Shumard, Trans. Acad. Sci., St. Louis, Vol. 1, p. 291.

White Limestone of the Guadalupe Mountains.

P. pileolus, Shumard, Trans. Acad. Sci., St. Louis, Vol. 1, p. 291.

White Limestone of the Guadalupe Mountains.

P. semireticulatus, var. antiquatus, Martin, Petrif. Derb., p. 7, pl. 32, fig. 1–2, and pl. 33, fig. 4.

White Limestone of the Guadalupe Mountains.

P. Popei, Shumard, Trans. Acad. Sci., St. Louis, Vol. 1, p. 290, pl. XI., fig. 8.

A number of specimens of this species are in the collection, all of them from the White Limestone of the Guadalupe Mountains. There are two distinct varieties; one having a remarkably deep sinus with five to seven costæ on either side, and the other with a less profound sinus and from eight to thirteen costæ. The latter variety, I, at first, regarded as a distinct species, but a more thorough examination of a number of specimens has led to the opinion that it should not be separated from the species above cited.

P. Norwoodii, Swallow, Trans. Acad. Sci., St. Louis, Vol. 1, p. 182.

A single specimen of the ventral valve of this species is in the collection of the Expedition. It was found in the Dark

Limestone, towards the base of the Guadalupe Mountains, Texas.

P. LEPLAYI (?) Verneuil, Geol. Russ., Vol. 2, p. 267, pl. 16, fig. 1 a—b.

The specimen, which I refer with doubt to this species, is partially embedded in the matrix. The principal difference that I perceive is in the spines on the ears, which are more robust in the Texas shell.

White Limestone of the Guadalupe Mountains.

GENUS STROPHALOSIA.

S. (AULOSTEGES) GUADALUPENSIS, Shumard, Trans. Acad. Sci., St. Louis, Vol. 1, p. 292. pl. XI., fig. 5.

White Limestone of the Guadalupe Mountains.

GENUS CHONETES.

C. PERMIANA, n. sp.

Shell small, sub-semicircular, widest at the cardinal border, width one-third greater than the length, front and sides rounded. Ventral (receiving) valve moderately convex, without mesial sinus; cardinal margin sloping gently from beak to extremities and marked with five or six spines; ears mucronate, gently convex and separated from the vault by a gentle depression. Ventral valve and area unknown. Surface marked with extremely fine concentric striæ of growth.

I have several specimens of this species before me, none of which exhibit any traces of longitudinal striæ.

Found in the Conglomerate at the mouth of Delaware Creek, Texas.

C. FLEMINGI (?) Norwood & Pratten, Jour. Acad. Nat. Sci., Phila., 2d Ser., Vol. 3, p. 26, pl. 2, fig. 5 a—e.

The fossil from the White Limestone of the Guadalupe Mountains corresponds pretty well with the figures and description of the above cited species, though I can see minor points of difference which leave me in doubt as to whether it is really identical.

GENUS SPIRIFER.

S. MEXICANUS, Shumard, Trans. Acad. Sci., St. Louis, Vol. 1, p. 292, pl. XI., fig. 4.

This species bears considerable resemblance to *S. duplicos-*

tata, Phillips, as figured by Mr. Davidson in his excellent monograph on the British Carb. Brachiopoda. Our shell is, however, much more gibbous and attains a much greater size.

Locality.—White Limestone, Guadalupe Mountains.

S. Guadalupensis, n. sp.

Shell of medium size, ovate, longer than wide, quite gibbous in full grown specimens; hinge line less than the greatest width, which is found about the middle of the shell; dorsal valve varying from elliptical to circular, evenly convex, exhibiting no trace of a mesial fold; beak incurved, passing a little beyond the cardinal margin; ventral valve convex, much more gibbous than the opposite valve, without sinus, but in very old specimens flattened near the front; cardinal angles rounded; umbo prominent, rounded; beak prolonged, rather acute, incurved; area contracted, elevated, not very sharply defined; aperture large, triangular; length of sides and base nearly equal; surface marked with moderately distinct concentric striæ, the edges of which were probably fringed with piliform spines as in *S. lineata*.

This species may be compared with *S. lineata*, from which it differs in being much more gibbous, and in the absence of either sinus or mesial fold. The same characters will also distinguish our shell from *S. setigera*, Hall.

Locality.—White Limestone, Guadalupe Mountains.

S. sulciferus, Shumard, Trans. Acad. Sci., St. Louis, Vol. 1, p. 298, pl. XI., fig. 8.

Locality.—White Limestone, Guadalupe Mountains, Texas and New Mexico.

S. cameratus, Morton, Silliman's Jour., 1st Ser.

The ventral valve of a well marked example of this species was found in the Sandstone towards the base of the Guadalupe Mountains, and fragments of it were also procured from the White Limestone.

Genus Spiriferina.

S. Billingsii, Shumard, Trans. Acad. Sci., St. Louis, Vol. 1, p. 294.

Some of the varieties of this shell correspond so nearly with *S. cristata* as figured by Davidson in his monographs on the British Perm. and Carb. Brachiopoda, that I am in doubt whether our shell is really entitled to be considered distinct from that species. It is desirable that a direct comparison should be made with authentic European specimens, in order to settle the question.

Locality.—White and Dark Limestone, Guadalupe Mountains.

GENUS TEREBRATULA.

T. ELONGATA, Schlotheim.

I have before me a number of examples of Terebratula which appear to be identical with this remarkably variable Permian shell. Some of them present all the characters of *T. elongata* proper; others have the wider and more inflated form of the variety *T. sufflata;* while others again exhibit a distinctly impressed though shallow sinus near the front of the dorsal valve as in *T. saccula* of the Carboniferous Period.

T. PERINFLATA, n. sp.

Shell ovate, very gibbous, width and thickness about equal, one-third longer than wide in full grown specimens; front subtruncate or slightly emarginate; sides rounded anteriorly and converging posteriorly to the beak at an angle of about 55°. Dorsal valve varying from circular-ovate to subcircular, convex, forming usually a regular curve from beak to front, old specimens marked with a slight mesial elevation in front and an obscure fold on either side, which become entirely obsolete before reaching the middle of the valve; cardinal edges rather deeply indented by the false area of the ventral valve. Ventral valve strongly convex, more elevated than the opposite valve, front marked with a shallow sinus, which usually becomes obsolete before reaching the middle of the valve; beak extended considerably beyond that of the dorsal valve, acute and strongly incurved; surface marked with fine concentric striæ of growth.

Dimensions of a full grown specimen—Length, 0.67; width, 0.52.

Form. and Loc.—White Limestone of the Guadalupe Mountains, Texas. It appears to be quite rare, only two specimens having been found.

GENUS RHYNCHONELLA.

R. GUADALUPÆ, Shumard, Trans. Acad. Sci., St. Louis, Vol. 1, p. 295, pl. XI., fig. 6.

Restricted to the White Limestone of the Guadalupe Mountains.

R. INDENTATA, n. sp.

Shell variable, subovate, gibbous, length and breadth about equal, sides converging rapidly from the middle of the shell to the beak, and rounded towards the front, which is slightly indented. Dorsal valve strongly arched, much more elevated than the ventral valve; umbo flattened, broadly and rather deeply excavated in front by the tongue of the opposite valve; mesial ridge slightly elevated, and in some specimens scarcely perceptible except at the front; lateral margins very sinuous, being deeply indented at the cardinal margin on either side of the beak by the false area of the opposite valve; beak flattened and closely incurved. Ventral valve convex in the umbo and sides, scarcely gibbous, having a broad shallow sinus, which becomes obsolete on the umbo; false area well developed, distinctly defined, depressed below the plane of the dorsal valve, and marked with fine striæ; beak acute and moderately incurved. Surface marked with fine striæ of growth and from 20 to 25 rounded radiating costæ, which become obsolete on the umbo; costæ in the mesial fold and in the sinus.

Dimensions.—Length, 0.55; width, 0.50; thickness, 0.40.

Locality.—White Limestone of the Guadalupe Mountains.

R. TEXANA, n. sp.

Shell small, ovate, moderately gibbous, front rounded or slightly indented; antero-lateral margins rounded, converging posteriorly to the beak at an angle of 63°. Dorsal valve as broad as long, convex, more elevated than the ventral valve, smooth on the umbo and having a distinct mesial elevation in front, bearing usually three prominent subangular ribs, on either side of which are two or three less prominent ribs; cardinal edges rather deeply indented by the false area of the opposite valve. Ventral valve gently convex, most prominent about the middle, marked in front with a moderately deep mesial sinus, which becomes obsolete on the umbo and bears two or more subangular ribs; beak prolonged, acute gently; foramen narrow, triangular; false area rather strongly developed, not very distinctly defined.

Dimensions.—Length, 0.35; width, 0.30; thickness, 0.22.

Form. and Loc.—From the Dark Limestone forming the base of the Guadalupe Mountains, and from the Conglomerate at the mouth of Delaware Creek.

RHYNCHONELLA, sp. (?)

There are fragments of a large Rhynchonella in the collection, which belong to a species similar to *R. pentatoma*,

new, viz., the XVIIIth Dynasty. As, then, this Dynasty, down to Ramses' death, in 1606 B. C., governed during 298 years, its first king, Amos, must have been upon the throne about 1904 B. C.; consequently, the Israelites left Egypt, not, as is universally supposed, in 1500 B. C., but 400 years earlier, exactly in 1867 B. C., as follows from the detailed Biblical biography and the remarkable conjunction of Saturn and Jupiter in Pisces in 1951 B. C., three years previous to the birth of Moses; which phenomenon is mentioned by Josephus and the Rabbis. As, then, the Exodus happened 400 years before its formerly fixed year, it is obvious that all the preceding Biblical epochs are to be put earlier by 400 years, as the planetary configurations, referring to the deluge and the ages of the world, confirm. This matter has been treated *in extenso* in my Chronologia Sacra and the Summary of Recent Discoveries.

6. The same planetary configuration gives another instance of the necessity of correcting the usual planetary tables. The longitude of Jupiter in Cancer is, according to Lalande's Tables, as we have seen, too great by four degrees; as my calculation, however, is not exact, and the perturbations of Jupiter sometimes are considerable, I drop the investigation concerning this planet. As to the Moon, however, it is obvious that the said excess of at least 6 degrees materially affects our Tables. The Egyptian astronomers, having proved themselves, as many other monuments show, able to determine the places of the planets to the nicety of half a degree, could not have committed a mistake of 6 degrees, or 12 diameters of the full Moon; and, since very important modifications of a beginning year depended, according to their belief, on the position of the god of the Moon, at its nativity, they would not have carelessly placed the Moon in two totally wrong planetary departments. Besides, the time of that observation, viz., about sunset, is equally sure. For, as the Moon stood only 20 degrees East from the Sun, her setting took place one hour and twenty minutes after that of the Sun, the parallax neglected; consequently, the Moon remained invisible the whole subsequent night, and the next following evening the Moon stood in another Sign, 13° E. from her former place, and not "in the same house with the Sun." Thus, the only possibility left is, that our Lunar Tables are incorrect; and this assertion, though bold, is verified as well by the known carelessness of Ptolemy, the real originator of all the subsequent Lunar Tables, as by the total eclipse of the Sun observed in 1851 in Europe, and by a great multitude of solar and lunar eclipses observed by the Ancients.

First, Ptolemy (130 A. C.), in his Almagest, mentions 19

eclipses of the Moon, inclusive of 7 old Babylonian ones, connected with certain years of certain kings, and, regarding their time and dimension, calculated by himself to minutes*; in doing so, however, he had the misfortune of following the very incorrect chronological tables already in use in his days. The oldest eclipse, that in the first year of Mardokempad, e. g., occurred not in 720 but in 721 B. C., and also all the others in other years; thus, Ptolemy could not but incorrectly determine the said mean motion of the Moon, the lunar nodes, and so on. All subsequent authors of Lunar Tables relied upon Ptolemy's calculations, but never succeeded in constructing exact Tables. A few years after new Tables had been constructed, it became apparent that they did not correspond with the latest observations, on account of Ptolemy's theory being wrong. The same must be said of the celebrated Tables of Burckhardt and those of Damoiseau; for, on occasion of the total eclipse in 1851, it was brought to light that the Moon was again 57 seconds slower than these, our best Tables, with Airy's corrections, had determined. The longitude of the Moon was 37 seconds shorter than that obtained by the Tables. The same is proved by 28 ancient eclipses, the more so the older they are. Thus, e. g., that authenticated solar eclipse which was seen in Rome in 752 B. C., May 25, 16h. Par. time, took place, according to the modern tables, at least 2h. 40m. before sunrise; consequently, the mean motion of the Moon, as determined by Ptolemy, and adopted in all subsequent tables, must be too great. The total eclipse of the Moon observed at Babylon, in 721 B. C., Sept. 23, 1h. 40m. P. T., took place, according to our Tables, at least 1h. 30m. before sunset. The total eclipse of the Sun observed at Rome, in 642 B. C., Jan. 11, 18h. P. T., preceded sunrise nearly 2h. 50m. The total eclipse of the Sun seen on the Halys, 36° E. from Paris, viz., in 581 B. C., Mar. 27, 17h. 45m. P. T., preceded sunrise at least 40m. That total eclipse of the Sun observed near Smyrna in 478 B. C., Feb. 27, 15h. 30m., preceded sunrise nearly 2h. 50m. The nearly total eclipse of the Sun observed at Athens in the afternoon, as Thucydides testifies, in 429 B. C., Jan. 26, 22h., must have taken place 2h. 30m. later. To these may be added more than twenty similar eclipses, which concur in proving that the secular mean motion of the Moon, adopted in all Lunar Tables down to this day, is somewhat too great.

The present astronomers, forced by the before-mentioned solar eclipse in 1851, have, indeed, already attempted to rec-

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* See Goettingische gelehrte Anzeigen, 1855, No. 125, pp. 1241—'75.

of the single deities were chosen.† Some of the 7 planets and the 12 Great Gods were called by similar names and represented by similar images, because the planets were the presidents of all the segments of the Zodiac. These and other particulars are confirmed again by the astronomical inscription on the Leeds mummy-coffin. In short, then, the deities of the ancients were, in higher respects, God's ministers or angels—in later times, spirits—residing in the planets and constellations, and in their own creatures.

4. The Leeds coffin, being to-day nearly 3520 years old, confirms, by a new and mathematical proof, the true history and chronology of the Egyptians, and confutes many a celebrated book; for it is known that for 400 years innumerable attempts were made in order to determine the time of the single Egyptian dynasties, and that in consequence of the corrupted figures in the Vetus Chronicon, Josephus, Africanus, Eusebius, the Armenian Eusebius, Syncellus, and others, not one of them corresponds with the other.‡ Regarding the XVIIIth Dyn., we find differences of many hundred years in the works of Ameilhon, Perizonius, Savigny, Bovet, Mure, Champollion Figeac, Rosellini, Crothwaite, Archinard, Henry, Felix, Leseur, Sharpe, Barucchi, Maury, Rask, Vaucelle, Bunsen, Lepsius, and others. Mr. Osburn himself ascribes to the Pharaoh Ramses Meiamun, the last king of the XVIIIth Dyn., the period from 1493 to 1473 B. C. In 1833, however, the nativity of this same Ramses, represented on his magnificent granite sarcophagus in the Louvre, and some years after, the nativity of Ramses' father and predecessor, Osimanpta, represented on the costly alabaster sarcophagus in Saone's Museum at London, came to light; and what was now the time of the combined government of Osimanpta and Ramses? The latter was born in 1693, the former in 1730 B. C.; consequently, they reigned at least 200 years before the time fixed by Mr. Osburn and Champollion. With reference to the nativity of the successor of Ramses Meiamun, called Sethos, the first king of the XIXth Dyn., preserved on his grand sarcophagus in the British Museum—which nativity, as I also showed, in 1833, in my Egyptian Astronomy, refers to the

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† Cicero N. D. I. 13: Sunt dii octo, quinque qui in vagis stellis (planetis) nominantur, unus (mundus), qui ex omnibus sideribus, quæ infixa cœlo sunt, ex diversis quasi membris, simplex sit putandus deus, septimus Sol, octavus Luna. Clemens Al. Protr., p. 44: Septem sunt dii planetæ, octavus vero, qui ex his omnibus constat, mundus.

‡ Of the same kind is the very large work of Mr. Lepsius, recently published, entitled the "Koenigsbuch der alten Ægypter." I have examined it, and seen that, from Menes down to Titus, it does not contain a single true date.

year 1631 B. C.,—the governments of the said kings were fixed thus:

1730	B. C.	Osimanpta born.
1693	"	Ramses Meiamun born.
1692	"	Osimanpta still governs alone.
1691	"	Ramses M. governs together with his father.
1631	"	Sethos, the first king of the XIXth Dynasty, born.
1606	"	Ramses Meiamun dies.

At present, the Leeds Nativity says to us that the deceased, being a contemporary of Osimanpta and Ramses, was born in 1722 B. C., i. e., 8 years after Osimanpta, and 29 years before Ramses; consequently the said Pharaohs, indeed, must have governed from 1691 to 1606 B. C. Further, as Ramses died in 1606 B. C., and as from Amos I., the first king of the XVIIIth Dyn., down to the expiration of the XVIIIth Dynasty, 298 years elapsed, the government of this Dynasty must have begun 1904 B. C., which date is confirmed by the transit of Mercury, and the renewal of a Phœnix-period of 651 years, during the government of Amos I. Finally, as, according to Eratosthenes, the Tables of Karnak and Abydos, and the Vetus Chronicon, Menes reigned 1175 years previously to Ramses' death [in 1606, the Egyptian empire must have begun in 2781 B. C., together with the first Canicular Period; which date is supported historically by Herodotus and the Vetus Chronicon, mathematically by the Nativity of the Egyptian empire, represented on sixteen monuments, and referring to the year 2781 B. C. For a chronologer, who had fixed the times of Ramses, Amos I., and Menes, very differently from all his predecessors, nothing could be more comforting than to meet with an astronomical monument verifying his chronological statements, many years after, with mathematical certainty.

5. The same astronomical inscription confirms also the true Biblical history and chronology. For, in consequence of the passage 1 Kings 6, 1, according to which, not 880 but 480 years, or, as the Septugint reads, 440 years only elapsed from the Exodus to the building of Solomon's temple, all the Biblical Chronologies now in vogue put the dispersion of the nations, the deluge, the creation, 400 years too late. The Book of Judges, the genealogies in the Old Testament, and Josephus, however, testify that 880 years intervened between the Exodus and Solomon's temple, and that is what our inscription also confirms. For, the Fathers of the Church relate that the Israelites left Egypt under Amos, the first king of the XVIIIth Dyn., and in Exod. 1, 8, we read: "There arose up a new king over Egypt, which knew not Joseph," i. e., not the son of the preceding king, but the first king of a

new, viz., the XVIIIth Dynasty. As, then, this Dynasty, down to Ramses' death, in 1606 B. C., governed during 298 years, its first king, Amos, must have been upon the throne about 1904 B. C.; consequently, the Israelites left Egypt, not, as is universally supposed, in 1500 B. C., but 400 years earlier, exactly in 1867 B. C., as follows from the detailed Biblical biography and the remarkable conjunction of Saturn and Jupiter in Pisces in 1951 B. C., three years previous to the birth of Moses; which phenomenon is mentioned by Josephus and the Rabbis. As, then, the Exodus happened 400 years before its formerly fixed year, it is obvious that all the preceding Biblical epochs are to be put earlier by 400 years, as the planetary configurations, referring to the deluge and the ages of the world, confirm. This matter has been treated *in extenso* in my Chronologia Sacra and the Summary of Recent Discoveries.

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eclipses of the Moon, inclusive of 7 old Babylonian ones, connected with certain years of certain kings, and, regarding their time and dimension, calculated by himself to minutes*; in doing so, however, he had the misfortune of following the very incorrect chronological tables already in use in his days. The oldest eclipse, that in the first year of Mardokempad, e. g., occurred not in 720 but in 721 B. C., and also all the others in other years; thus, Ptolemy could not but incorrectly determine the said mean motion of the Moon, the lunar nodes, and so on. All subsequent authors of Lunar Tables relied upon Ptolemy's calculations, but never succeeded in constructing exact Tables. A few years after new Tables had been constructed, it became apparent that they did not correspond with the latest observations, on account of Ptolemy's theory being wrong. The same must be said of the celebrated Tables of Burckhardt and those of Damoiseau; for, on occasion of the total eclipse in 1851, it was brought to light that the Moon was again 57 seconds slower than these, our best Tables, with Airy's corrections, had determined. The longitude of the Moon was 37 seconds shorter than that obtained by the Tables. The same is proved by 28 ancient eclipses, the more so the older they are. Thus, e. g., that authenticated solar eclipse which was seen in Rome in 752 B. C., May 25, 16h. Par. time, took place, according to the modern tables, at least 2h. 40m. before sunrise; consequently, the mean motion of the Moon, as determined by Ptolemy, and adopted in all subsequent tables, must be too great. The total eclipse of the Moon observed at Babylon, in 721 B. C., Sept. 23, 1h. 40m. P. T., took place, according to our Tables, at least 1h. 30m. before sunset. The total eclipse of the Sun observed at Rome, in 642 B. C., Jan. 11, 18h. P. T., preceded sunrise nearly 2h. 50m. The total eclipse of the Sun seen on the Halys, 36° E. from Paris, viz., in 581 B. C., Mar. 27, 17h. 45m. P. T., preceded sunrise at least 40m. That total eclipse of the Sun observed near Smyrna in 478 B. C., Feb. 27, 15h. 30m., preceded sunrise nearly 2h. 50m. The nearly total eclipse of the Sun observed at Athens in the afternoon, as Thucydides testifies, in 429 B. C., Jan. 26, 22h., must have taken place 2h. 30m. later. To these may be added more than twenty similar eclipses, which concur in proving that the secular mean motion of the Moon, adopted in all Lunar Tables down to this day, is somewhat too great.

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oncile Burckhardt's and Damoiseau's Tables with the heavens, not by diminishing the supposed secular mean motion of the Moon, but by changing its supposed anomaly. This proceeding, however, is in conflict with our Egyptian astronomer, and with 28 of the ancient eclipses specified in the chronological Tables appended to my Summary; according to which, the adopted mean motion of the Moon is to be diminished before all. The modern theory of the Moon supposes the Moon to move, in 100 years, 9 signs, 7 degrees, 53 minutes, and 10 seconds; but, in 1722 B. C., the place of the Moon was at least 6 degrees West from the point fixed according to the said secular mean motion of the Moon; i. e., the Moon did not reach that place till nearly 12 hours later. It may be granted that the Egyptian astronomers observed the Moon one hour after sunset, while the horizontal parallax took two hours; then the fault of the modern Tables concerning the epoch of 1722 B. C. amounts to 9 hours only. We may further suppose that the half of those 57 seconds, by which the total eclipse in 1851 began too late, equally affects the lunar anomaly, being also based upon Ptolemy's wrong theory, and that accordingly, in 1700 A. C., the Moon reached a place in the Zodiac only 30 seconds later than our Tables say; that, finally, the acceleration of the Moon, like that of the lunar nodes, is equal to the squares of the times. These cases being admitted, I say that, in 1722 B. C., Oct. 7, 7h., the Moon really stood nearly 6 degrees West from the place obtained by the present Tables; consequently, in fact, 19 degrees East from the Sun, as the Egyptian astronomers observed.

And this result agrees perfectly well with the ancient eclipses; for then, e. g., in 752 B. C., the Moon was nearly 5 hours later in conjunction with the Sun, and the eclipse was seen in Rome 2 hours after sunrise. The same holds with the said Roman eclipse in 642 B. C., and all the rest. That famous total eclipse of the Sun, near Smyrna, in 478 B. C., Feb. 27, 15h. 13m., took place not 2 hours 50 minutes before sunrise, but it began with sunrise, as Herodotus relates, and so on.

These calculations are not at all exact, but real astronomers will excuse that; notwithstanding, I take the liberty of calling their attention to an important object, which involves a correct theory of the Moon, and exact Lunar Tables.

Notice of Fossils from the Permian Strata *of Texas and New Mexico, obtained by the United States Expedition under Capt. John Pope for boring Artesian Wells along the 32d Paral., with Descriptions of New Species from these Strata and the Coal Measures of that region.*

By B. F. Shumard, M.D.

PERMIAN FOSSILS.

At the meeting of March 8, 1858, I had the honor of announcing to the Academy the existence of an extensive development of Permian Rocks in the Guadalupe Mountains of Texas and New Mexico. This announcement was based upon a rather hasty examination of a series of fossils collected by my brother, Dr. Geo. G. Shumard, while acting as Geologist of the U. S. Expedition for boring Artesian Wells along the 32d Parallel, under the direction of Capt. John Pope. The present communication embraces the results of a more thorough investigation of this interesting collection of fossils, which Capt. Pope has had the kindness to place in my hands for determination and description. It will be seen that the list contains a number of species that occur in the Permian beds of Kansas, and which have been described in the valuable papers of Messrs. Swallow and Hawn and Messrs. Meek and Hayden. Others are identical with characteristic fossils of the Permian beds of England, Germany, and Russia. But the largest proportion of species are new to science.

I would further observe, that Prof. Marcou, in the map accompanying his late work on the geology of North America*, has colored that portion of the Guadalupe Mountains whence our Permian fossils were obtained as Coal Measures and Lower Carboniferous, and that the rocks described by him as of Permian age do not agree in lithological features with the Guadalupe strata.

ZOOPHYTA.

Chætetes Mackrothii, Geinitz.

Our specimens apparently agree in every particular with the figures and descriptions of this species, as given in the works of Geinitz and King.

Locality.—Dark Limestone of the Guadalupe Mountains.

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* Geol. of N. Amer., Zurich, 1858.

angle 37°; volutions six or seven, convex; body volution ornamented, usually, with six rounded carinæ, of which the two upper ones are quite prominent and separated by a deep furrow; remaining volutions each with two strong carinæ. Surface marked with numerous longitudinal, flexuous folds or striæ, becoming thickened as they pass over the carina, to which they give a subnodulose appearance; suture deeply impressed; aperture oblique ovate.

Dimensions.—Length, 0.26; width, 0.16.

Geol. Pos. and Loc.—Found with the last. It is an extremely neat and elegantly ornamented species, and if we may judge from the number of specimens brought home by the Expedition, it is quite abundant at this locality.

MACROCHEILUS TEXANUS, n. sp.

Shell of moderate size, ovate; length greater than the width; volutions five, evenly convex; body volution large gibbous, occupying about three-fourths of the total length; spire diminishing rapidly to the apex which is pointed; spiral angle 69°, suture slightly impressed; aperture oblique, elongate subovate, occupying rather more than half the length of the shell, angulated above, rounded below, outer lip somewhat regularly arched, inner lip sinuate. No surface markings are perceptible on any of the specimens that have come under our observation.

Dimensions.—Length, 0.76; width, 0.46; length of aperture, 0.42; width of same, 0.13.

This shell is very similar to *Macrocheilus ponderosus*, Swallow, a species of the Coal Measures of Missouri and Kansas; but ours is a smaller shell and the proportions different.

Form. and Loc.—Same as last species. Collected, together with the others, by Dr. G. G. Shumard, Geologist of the Expedition.

them, however, preserve the surface markings, distinctly, and in this particular they agree well with some of the varieties of *Monotis speluncaria*, as represented in the figures given by King and Geinitz.

The clear description of Messrs. Meek and Hayden of the surface of *M. Hawni*, likewise applies exactly to that of our specimens, so that there exists but little doubt with regard to the identity of the Kansas and Texas fossil. Nevertheless, without pretending, from the imperfect material before me, to decide whether the American and European forms are the same, I refer my specimens to *M. speluncaria*. In doing so, I may remark that my cabinet contains a number of authentic specimens of *M. speluncaria* from the Zechstein dolomite of Germany, none of which show the beak of the larger valve so much elevated as represented by Prof. King in the Permian monograph, but, in most of them, the beak passes very slightly above the hinge. The posterior sulcus, too, in several of them, is but imperfectly defined. It would seem, therefore, that the characters chiefly relied on by Meek and Hayden, namely, "beak extending little above the hinge," and absence of posterior sulcus, will not serve to distinguish the *M. Hawni* from at least some of the varieties of *M. speluncaria*.

Locality.—White and Dark Limestone, Guadalupe Mountains.

MONOTIS, sp. (?)

This is a very large species and apparently distinct from the preceding. In general form and size, it resembles *M. Halli* of Swallow, but the radiating and concentric striæ are much less prominent. There is but one example in the collection and that imperfect.

Locality.—White Limestone, Guadalupe Mountains.

GENUS AXINUS.

A. SECURUS, n. sp.

Shell compressed, length and height nearly equal; anterior margin gently curved, and about one-third shorter than the basal margin, which is gently rounded; posterior extremity rather sharply angulated; posterior slope obtusely subangular. Surface markings unknown.

Resembles *A. rotundatus*, Brown; but the valves of our species are more flattened, the buccal margin longer and not so strongly arched, and the beak is situated nearer the anterior extremity.

Locality.—White Limestone, Guadalupe Mountains.

angle 37°; volutions six or seven, convex; body volution ornamented, usually, with six rounded carinæ, of which the two upper ones are quite prominent and separated by a deep furrow; remaining volutions each with two strong carinæ. Surface marked with numerous longitudinal, flexuous folds or striæ, becoming thickened as they pass over the carina, to which they give a subnodulose appearance; suture deeply impressed; aperture oblique ovate.

Dimensions.—Length, 0.26; width, 0.16.

Geol. Pos. and Loc.—Found with the last. It is an extremely neat and elegantly ornamented species, and if we may judge from the number of specimens brought home by the Expedition, it is quite abundant at this locality.

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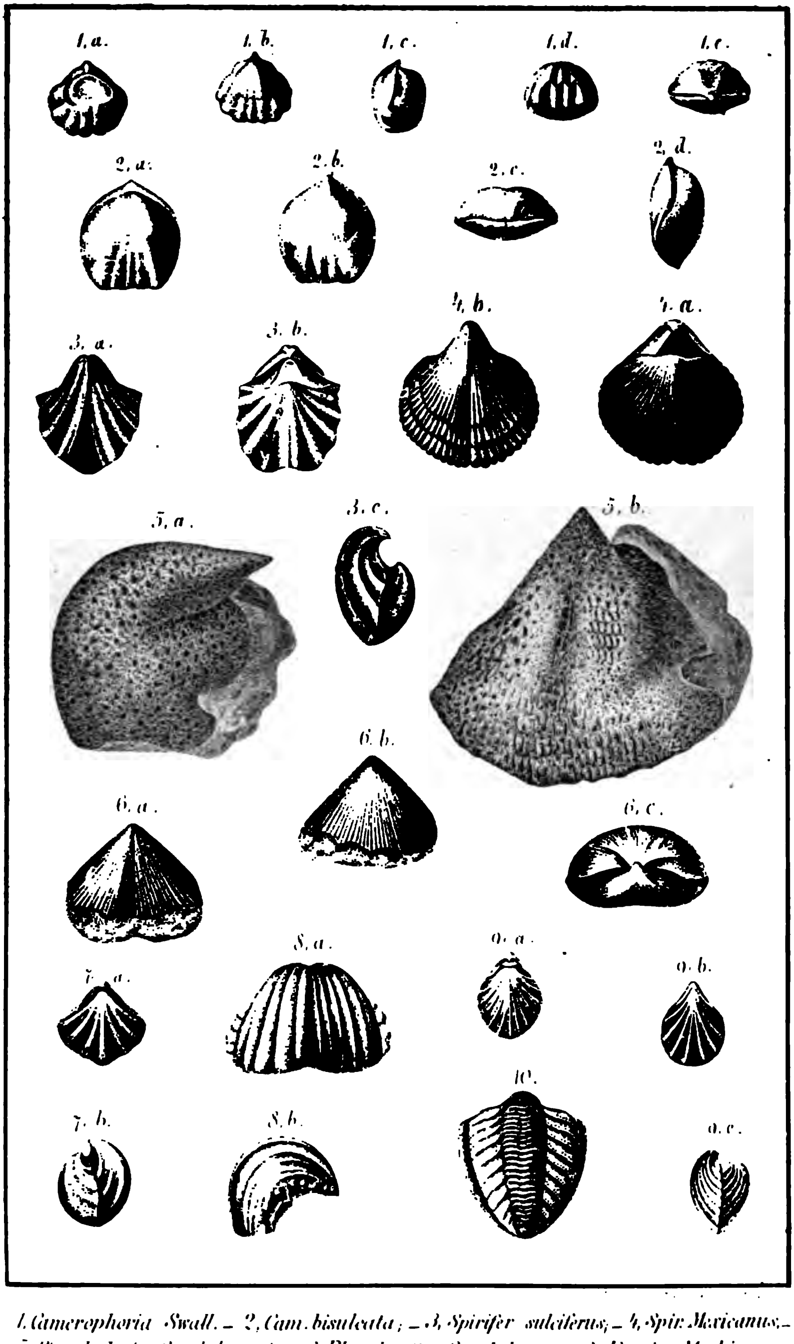
Shell of moderate size, ovate; length greater than the width; volutions five, evenly convex; body volution large gibbous, occupying about three-fourths of the total length; spire diminishing rapidly to the apex which is pointed; spiral angle 69°, suture slightly impressed; aperture oblique, elongate subovate, occupying rather more than half the length of the shell, angulated above, rounded below, outer lip somewhat regularly arched, inner lip sinuate. No surface markings are perceptible on any of the specimens that have come under our observation.

Dimensions.—Length, 0.76; width, 0.46; length of aperture, 0.42; width of same, 0.13.

This shell is very similar to *Macrocheilus ponderosus*, Swallow, a species of the Coal Measures of Missouri and Kansas; but ours is a smaller shell and the proportions different.

Form. and Loc.—Same as last species. Collected, together with the others, by Dr. G. G. Shumard, Geologist of the Expedition.



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EXPLANATION OF PLATE XI.

Fig. 1. Camerophoria Swalloviana, p. 394.

a—Dorsal view, showing the beak of opposite valve.
b—Ventral view.
c—Profile view.
d—View of the front.
e—Rostral view, showing the depression in the umbo of the dorsal valve.

Fig. 2. Camerophoria bisulcata, p. 296.

a—Dorsal view of a specimen more elongated than usual.
b—Ventral valve of same.
c—Front view of same.
d—Profile view of same.

Fig. 3. Spirifer sulciferus, p. 293.

a—View of the ventral valve.
b—View of dorsal valve, showing the beak and area of ventral valve.
c—Profile view.

Fig. 4. Spirifer Mexicanus, p. 292.

a—Dorsal view, showing beak, area, and foramen of opposite valve.
b—Ventral view.

Fig. 5. Strophalosia (Aulosteges) Guadalupensis, p. 292.

a—Profile view.
b—Ventral valve.

Fig. 6. Rhynchonella Guadalupæ, p. 295.

a—Ventral view.
b—Dorsal view.
c—Rostral view.

Fig. 7. Retzia Meekiana, p. 295.

a—Dorsal view.
b—Profile view.

Fig. 8. Productus Popei, p. 290.

a—Receiving valve.
b—Profile view.

Fig. 9. Retzia papillata, p. 294.

a—Dorsal view.
b—Opposite valve.
c—Profile view.

Fig. 10. Phillipsia perannulata, p. 296.

OBSERVATIONS *on the Geology of the County of Ste. Geneviève, being an extract from a Report made to the Missouri Geological Survey, in* 1859. By B. F. SHUMARD, M.D. (Communicated to the Academy by permission of Prof. G. C. Swallow, State Geologist.)

[Read June 6, 1859.]

This county contains about 486 square miles, and embraces within its limits considerable diversity of surface. In general terms it may be described as hilly; the hills rising sometimes to the height of 500 feet above the Mississippi, and from 50 to 300 feet above the adjacent streams. The general direction of the main ridges is N.E. and S.W. Many good farms are to be found on the highlands of different parts of the county, but there are some districts in which the surface is very uneven and the soil too light and sandy for successful cultivation. In the vicinity of the Junca and the head branches of the Aux Vases, the country is remarkably rough and broken. We find also some broken country bordering the valleys of the Mississippi, Saline, and Establishment. The alluvial bottoms of the streams throughout the county possess soils of great fertility, and well adapted to the growth of all the staples of the country. There are many fine farms to be seen along the Saline and its branches, the Aux Vases below the Junca, North and South Gabouri, Fourche à Polite, Establishment, Fourche à Duclos, and Isle au Bois Creeks.

Timber. — Nearly every part of Ste. Geneviève is supplied with timber in abundance. The valleys of the large streams are covered with a heavy growth of forest trees, as are also, frequently, the hill sides in their vicinity. On the head branches of the Aux Vases, Establishment, and Terre Blue, there are heavy forests of excellent pine, but the prevailing growth over a large portion of the highlands is black oak, black jack, post oak, and black hickory.

Streams.—Nearly all parts of Ste. Geneviève are well watered. The Mississippi forms the North-eastern boundary of the county and receives a multitude of small streams which rise chiefly in the Western townships.

GEOLOGY.

The Quaternary, Coal Measures, Carboniferous and Upper and Lower Silurian Systems are all more or less developed. The accompanying vertical section exhibits the thickness and relative position of the different members composing these systems, which we have recognized in Ste. Geneviève county.

QUATERNARY SYSTEM.

Alluvium.—This formation presents the usual characters of sand, clay, and humus, and good sections of it may be seen on the banks of most of the streams. The best section seen in the county is on the Saline, T. 36, R. 9, S.W. qr. of S. 1, where we find, 1st. Soil with a great deal of humus, 5 feet; 2d. Yellow arenaceous clay, 30 feet; plastic blue clay, 15 feet. Near this place Mr. B. Pratte of St. Mary's obtained in a well, 18 feet below the surface, a fine molar tooth of a *Mastodon.* The specimen was presented by Mr. Pratte to the Academy of Science of St. Louis, and is now preserved in the Museum of that institution.

Bluff.—This member is well developed on the highlands throughout the county, and consists of clay, sand, and marl. At Ste. Geneviève, from 30 to 50 feet of it is exhibited on the Gabouri, and at Brickey's Landing on the Mississippi, a thickness of near 60 feet was measured.

PALÆOZOIC ROCKS.

Upper Carboniferous or Coal Measures.—The *Coal Measures* are but sparingly represented in Ste. Geneviève. The inferior beds cap the hills a half mile above St. Mary's on the Mississippi. At this place, excavations have recently been made for coal to the depth of about 35 feet, and we find here the following section:

No. 1,	Slope covered with soil	134 feet.
" 2,	Blue and dark shale	8 "
" 2,	Purple arenaceous shale	2 "
" 4,	Fine-grained, yellowish, micaceous sandstone, containing carbonaceous matter and vegetable remains	28 "

A few hundred yards from this place the shales of this section present a thickness of 25 feet, and are surmounted by 10 or 12 feet of hard silicious limestone. It is not at all probable that any valuable seams of coal will be found in this neighborhood, as the strata dip rapidly towards the river.

LOWER CARBONIFEROUS OR MOUNTAIN LIMESTONE.

The Upper Archimedes (Kaskaskia Limestone of Prof. Hall's section of the rocks of the Mississippi Valley) succeeds in descending order the beds above described. It occurs at only a few points in the eastern corner of the county, and nowhere has its entire thickness been seen. It crops out on the bank of the Mississippi, just above St. Mary's, and on the Saline near its mouth. At these places it consists of thin beds lupe Mountains. I am unable to refer it to any of the known species, and it is too imperfect to permit me to make a satisfactory description of it.

ORTHOCERAS, sp. (?)

Locality.—Dark Gray Limestone towards the base of the Guadalupe Mountains, Texas.

PISCES.

The collection also contains scales and part of the tail of a fish, which appear to belong to a species of *Palæoniscus*. They are found in the Dark Limestone and Sandstone underlying the White Limestone of the Guadalupe Mountains.

CARBONIFEROUS FOSSILS.

GASTEROPODA.

TURBO TEXANUS, n. sp.

Shell small, rather thick, globose-conic, length equal to or greater than the width; spiral angle 55° to 60°; spire short conical, varying somewhat in length; volutions five, rounded, obtusely angulated above, the last one ventricose and forming two-thirds the entire height; suture distinct; aperture subovate, occupying about half the entire length, outer lip thickened as it joins the columellar lip; surface handsomely ornamented with revolving granose lines, of which there are seven or eight on the last volution, the grains on the upper line usually more prominent than the others. In some specimens, the revolving lines appear to be crossed with obscure oblique costæ.

Dimensions.—Length, 0.34; width, 0.25.

Our shell resembles *Turbo Mariæ*, Verneuil, but the spire is more elevated, and the body volution has fewer lines of tubercles.

Geol. Pos. and Loc.—Found abundantly in Dark Gray Limestone of the age of the Coal Measures, four miles west of the Sierra Hueco, El Paso Co., Texas.

STRAPAROLLUS CORNUDANUS, n. sp.

Shell depressed, discoid, spire gently concave, outer margins strongly carinate and subnodose; dorsum rounded and marked with two very shallow revolving channels, which are situated just without the carinæ; of these, the upper one is broadest and occupies about one-third the height of the volution; volutions four or five, flattened above and sloping gently from the carina to the suture; under surface of volutions rounded, the last one ornamented with arched folds, which are indistinct at the inner edge of the volution but become prominent as they approach the carina, which they render nodulose; suture strongly impressed; umbilicus very broad, deep, exhibiting all the volutions; aperture circular; surface marked with numerous fine striæ of growth, which are most distinct in the umbilicus.

Dimensions.—Length, 1.02; height at aperture, 0.42.

Form. and Loc.—In Dark Limestone of the Coal Measures, Sierra Cornudas, and four miles west of Sierra Hueco, El Paso county, Texas. All the specimens that have come under our observation are silicified.

PLEUROTOMARIA PROUTIANA, n. sp.

Shell small, turreted, conical, spiral angle 48°; volutions about five, strongly carinated in the middle, flattened on either side of the carina; last volution ventricose, margin subangulated below the carina, beneath rounded; surface of volutions marked with distinct revolving lines, which are finely granose and most prominent below the carina; these are crossed by longitudinal striæ and finer lines of growth; umbilicus very small, aperture subquadrangular.

Dimensions.—Length, 0.41 of an inch; width, 0.33.

Form. and Loc.—Coal Measures four miles west of Sierra Hueco, El Paso county, Texas.

PLEUROTOMARIA OBTUSISPIRA, n. sp.

Shell large, trochiform, depressed, conical, truncated at apex, strongly carinated at base and gently convex beneath; volutions six or seven, the two apicial turns gently convex and scarcely visible when the shell is viewed in profile; last volutions flat or slightly convex, strongly carinated at base; carina rounded, bearing the band of the sinus and limited above and below by a distinct revolving depression; suture distinctly marked; umbilicus large, round; surface marked with extremely fine striæ of growth; aperture varying from ovate to subquadrate.

The spiral angle of this species varies considerably with the age of the shell. The angle of a full grown specimen is 84°, of a young specimen, 56°.

Locality.—Coal Measures, four miles west of the Sierra Hueco, El Paso County, Texas.

PLEUROTOMARIA PERORNATA, n. sp.

Shell small, conical; length greater than the width, tapering somewhat regularly to the apex, which is pointed; spiral

angle 37°; volutions six or seven, convex; body volution ornamented, usually, with six rounded carinæ, of which the two upper ones are quite prominent and separated by a deep furrow; remaining volutions each with two strong carinæ. Surface marked with numerous longitudinal, flexuous folds or striæ, becoming thickened as they pass over the carina, to which they give a subnodulose appearance; suture deeply impressed; aperture oblique ovate.

Dimensions.—Length, 0.26; width, 0.16.

Geol. Pos. and Loc.—Found with the last. It is an extremely neat and elegantly ornamented species, and if we may judge from the number of specimens brought home by the Expedition, it is quite abundant at this locality.

MACROCHEILUS TEXANUS, n. sp.

Shell of moderate size, ovate; length greater than the width; volutions five, evenly convex; body volution large gibbous, occupying about three-fourths of the total length; spire diminishing rapidly to the apex which is pointed; spiral angle 69°, suture slightly impressed; aperture oblique, elongate subovate, occupying rather more than half the length of the shell, angulated above, rounded below, outer lip somewhat regularly arched, inner lip sinuate. No surface markings are perceptible on any of the specimens that have come under our observation.

Dimensions.—Length, 0.76; width, 0.46; length of aperture, 0.42; width of same, 0.13.

This shell is very similar to *Macrocheilus ponderosus*, Swallow, a species of the Coal Measures of Missouri and Kansas; but ours is a smaller shell and the proportions different.

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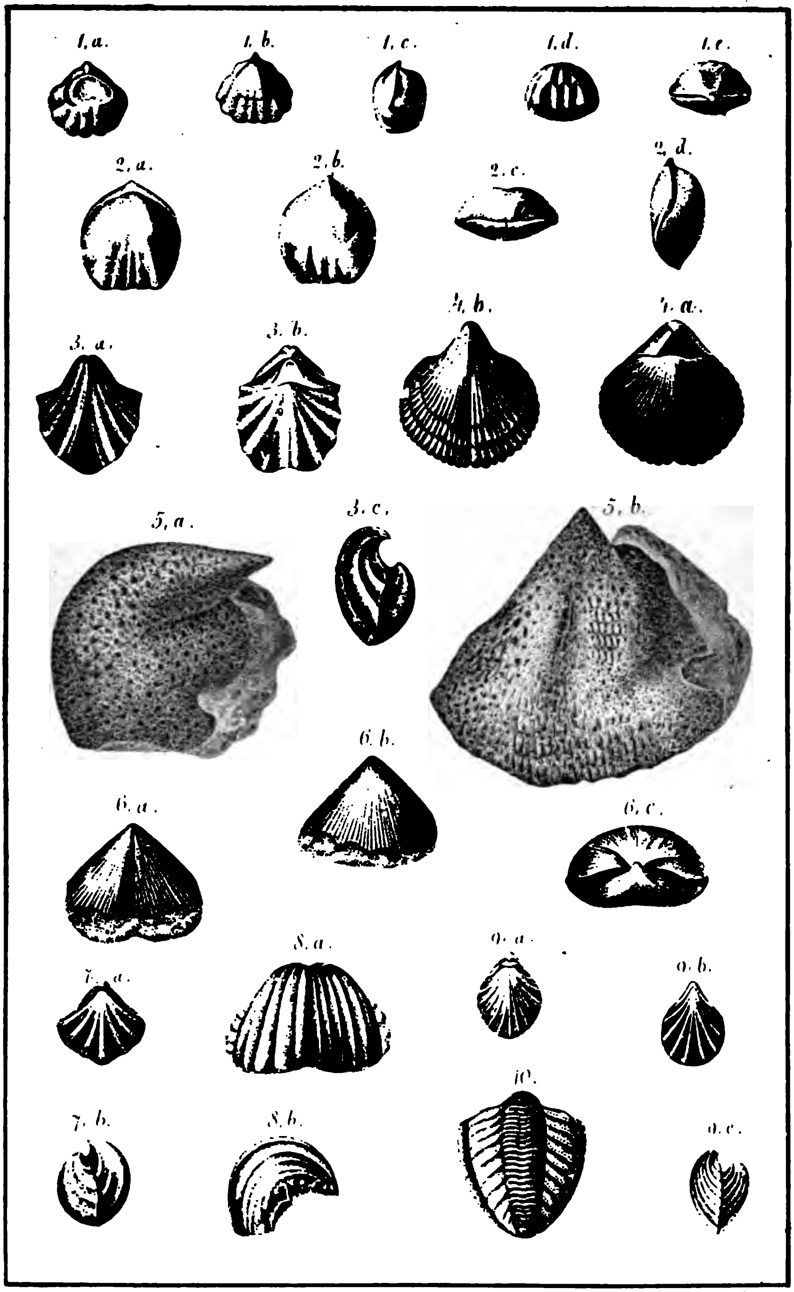

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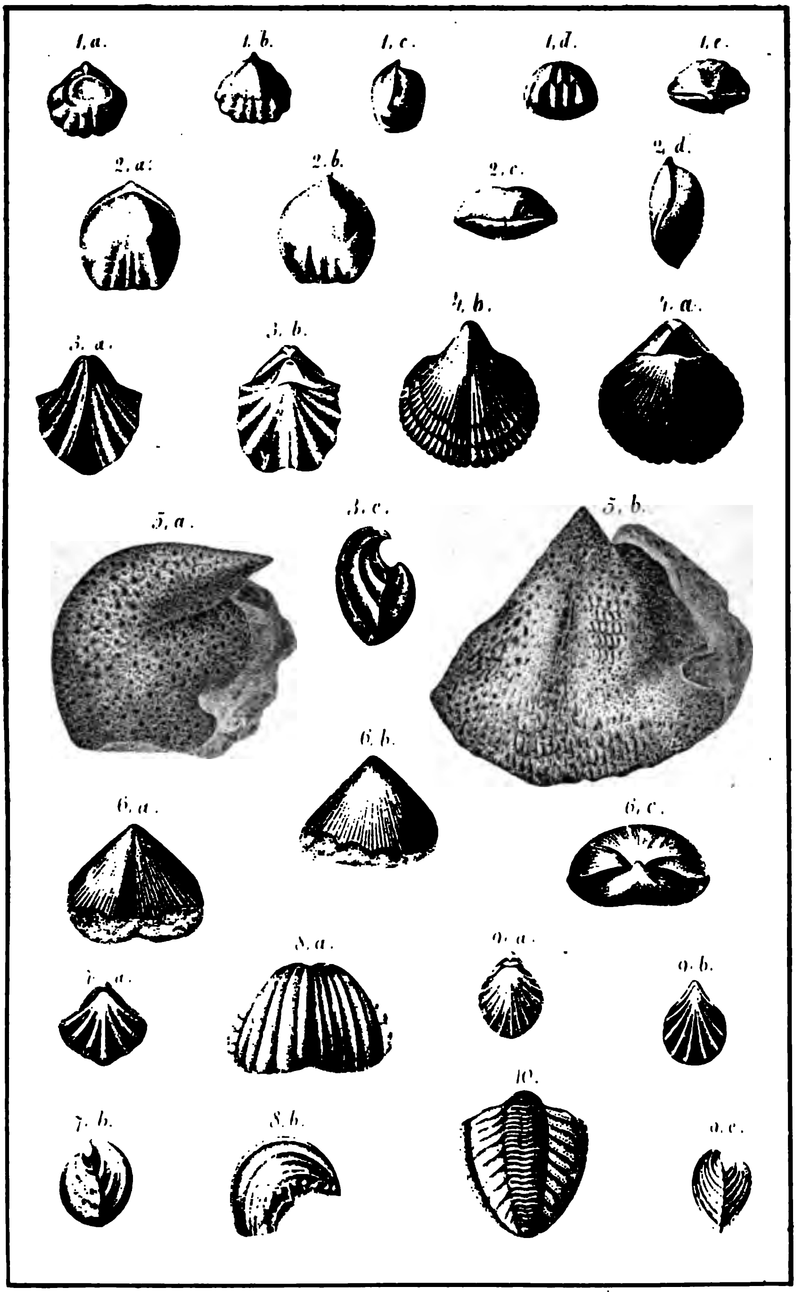

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Lower Carboniferous or Mountain Limestone.

The Upper Archimedes (Kaskaskia Limestone of Prof. Hall's section of the rocks of the Mississippi Valley) succeeds in descending order the beds above described. It occurs at only a few points in the eastern corner of the county, and nowhere has its entire thickness been seen. It crops out on the bank of the Mississippi, just above St. Mary's, and on the Saline near its mouth. At these places it consists of thin beds of grey limestone and bluish marl, highly charged with fossils, among which *Pentremites pyriformis*, *P. sulcatus*, *Agassizocrinus dactyliformis*, *Spiriferina spinosa*, *Spirifer trigonalis*, and several species of *Archimedipora*, are the forms most constantly observed.

Ferruginous Sandstone.—This formation comes next, and consists of thinly laminated quartzose sandstone, passing downwards into thick-bedded sandstone; sometimes assuming the character of a coarse gritstone, or even conglomerate with rounded pebbles of silex and jasper. It is exhibited along the bluffs bordering the alluvial bottom of the Mississippi, from a point about three miles from Ste. Geneviève to the mouth of the Aux Vases. Near the upper end of the exposure we find a thickness of about 40 feet resting on a limestone next to be described. Just above St. Mary's it again occurs on the Mississippi, dipping at a high angle and surmounted with the upper Archimedes limestone; we have estimated the thickness of the formation in Ste. Geneviève at from 80 to 100 feet, but we have not seen more than 40 feet exposed at any one locality.

Immediately beneath the ferruginous sandstone, we have a second Archimedes limestone which, for the sake of convenience, we may designate as the *Ste. Geneviève Limestone.** This member has been observed reposing on the St. Louis limestone at several points in the county under examination. It is very analogous, in its lithological features, to the upper Archimedes limestone, occurring, however, in thick beds, and the inferior part shades almost imperceptibly into the St. Louis limestone. It is exhibited in the bluffs of the Mississippi, commencing a mile or two below Ste. Geneviève, and from thence extends almost uninterruptedly to the mouth of Aux Vases Creek, receiving, at several points, a capping of *Ferruginous sandstone.* It likewise occurs on the hills, a

* This group is well displayed on the Illinois side, a short distance above Prairie du Rocher, where it was first recognized by my colleague, Dr. J. G. Norwood, with whom I visited the locality last summer. During our visit, we collected from these beds an interesting suite of fossils, some of which prove to be new, others are species of the Kaskaskia Limestone, but most of them are identical with forms that occur in the 2d. Archimedes or Warsaw Limestone of Prof. Hall's section. Among the species which have been recognized by us in these beds, we may mention *Rhynchonella trimedea*, *R. Wortheni*, *Spirigera hirsuta*, *Retzia Marcyi*, *Spiriferina spinosa*, *Spirifera Leidyi*, *Productus elegans*, *P. biseriatus*, *Murchisonia vermicula*, *Pentremites florealis*, and one or more species of *Archimedipora*.

We have likewise recognized these strata on the Illinois shore, below the mouth of Mary's River, where they contain a large *Pentremite*, which has been described by Mr. S. S. Lyon of the Kentucky Survey, under the name of *P. obesus*. The Archimedes beds are here surmounted with 80 feet of *Ferruginous Sandstone*.

short distance west of St. Mary's, and on the Saline, a mile or so above its mouth.

The *St. Louis Limestone*, which next succeeds, is not as well developed as in St. Louis county, and it also differs somewhat in physical characters. It is this rock that forms the cliffs along the gravel road above Ste. Geneviève, and those of the Mississippi, till we get about three miles above the town. At the lower end of this exposure, the strata are more or less oolitic, but in a short distance they assume the character of a heavy-bedded, gray limestone, and present a thickness of from 60 to 100 feet. On Gabouri Creek, this formation prevails from the mouth to a point about three miles above, where it is succeeded by a third Archimedes Limestone. At the oolitic quarries on the plank road, about two miles from Ste. Geneviève, we get the following instructive section of the lower beds of this formation:

No. 1.—Slope strewn with chert, and some masses of silicified *Lithostrotion* (*L. mammillare*)	50 feet.
No. 2.—Light gray sandy-textured limestone containing *Lithostrotion mammillare*, *Multipora* and *Archæocidaris*	60 "
No. 3.—White, highly oolitic limestone with *Lithostrotion*, *Archæocidaris*, and *Pentremites conoideus*	20 "

The oolitic beds, which here constitute the base of the St. Louis Limestone, form a handsome building material, for which purpose they have been somewhat extensively quarried here.

Below Ste. Geneviève, the formation under examination is again finely exhibited near the mouth of the Aux Vases, and enters largely into the composition of the cliffs for some distance above. It likewise appears in the bluffs of Saline Creek, in the vicinity of Saline Springs.

The entire thickness of the formation in this county has not been precisely ascertained, but it may be estimated at from 150 to 200 feet.

3*d*. *Archimedes Limestone*.—This comes next in descending order, and is the 2*d*. *Archimedes* or *Warsaw Limestone* of Prof. Hall's section. It also holds the same position as the Archimedes Limestone of Barrett's Station on the Pacif. Railroad, in St. Louis county, which has been used for building the Custom House at St. Louis. The formation is made up of gray and bluish-gray limestone, and the beds contain numerous columns of *Crinoids*, *Pentremites laterniformis*, *P. conoideus*, and a small undescribed species of *Pentremites*, *Dichocrinus simplex*, *Archimedipora*, *Spirigera hirsuta*, *Productus Indianensis*, *Rhynchonella subcuneata*, and *Holopea Proutiana*.

This formation may be seen on the Mississippi below the

Niagara Group.—This member occupies a narrow zone, scarcely a quarter of a mile in width, extending from a point near the Saline about five miles above the mouth, nearly west to James' Mill, on Mill Creek. It is entirely wanting in the northern half of the county. The beds are well displayed on the St. Mary's and Farmington road, about a mile west of the Saline. They present here a thickness of not less than 150 feet, and consist of compact calcareo-magnesian and argillaceous limestone, with *Caryocrinus ornatus*, *Eucalyptocrinus*, and *Haplocrinus*. At James' Mill, the formation is inclined at an angle of from 80° to 90°, and the beds have been considerably altered by volcanic agency, being converted into an extremely beautiful variegated marble of remarkably fine texture, and quite brittle. The rock passes through various shades of flesh-color, yellow, green, pink, purple, and chocolate, and in some masses the different colors are exquisitely and harmoniously blended.

Lower Silurian.

Hudson River Shale.—In descending the Mississippi, this formation was first observed about five miles above the mouth of Establishment Creek. A thickness of five feet is here exposed in a ravine, a short distance from the river. It has been here penetrated to the depth of 25 feet, down to the Receptaculite Limestone, in search of coal. It is a dark, bluish-gray argillaceous shale and contains a small *Lingula*. The same beds again appear in a ledge three feet high, at the mouth of the Establishment. It has not been recognized elsewhere in the county.

Receptaculite Limestone.—The upper 10 or 12 feet of this formation, in Ste. Geneviève, consists of thin layers of argillaceous and sub-crystalline limestone, filled with *Orthis occidentalis*, *Rhynchonella capax*, and *Leptæna sericea*; below this, it is usually a thick-bedded, white, and highly crystalline limestone, in which *Receptaculites*, *Illænus*, *Asaphus*, and *Orthis lynx*, are the most common fossils met with. On the Mississippi, it occupies the lower part of the bluffs from the Isle au Bois to the Establishment, being well displayed at Brickey's Landing, and at several points between these places and Salt Point. If we travel back from the river, in this part of the county, we find it reaching the tops of the hills at distances of from one half to three miles. South of the Establishment, it occupies a narrow zone, extending southwardly, crossing the Fourche à Polite, about three miles, and the North and South Gabouri Creeks, about six miles, above their mouths. On Mill Creek, near James' Mill, it again appears, dipping at an angle of about 50° N.N.E. The nital Limestone. The same strata again appear on Gabouri Creek, five miles from Ste. Geneviève.

Fossils are not abundant in this part of the Chemung. The species most frequently observed were *Orthis Michelini* (?) and *Spirifer Marionensis*.

The next member met with in the descending order is a sandstone. It was observed, at only a single locality in the county, by Mr. Hough, who found it resting immediately upon the Devonian rocks on the Little Saline Creek, in T. 36, R. 9, S. 2. He describes it as a thick-bedded silicious sandstone, in appearance very similar to the Saccharoid, and presenting a thickness of about 25 feet. So far as observed, it is destitute of fossils, and therefore it is not possible to say, whether it should be grouped with the Chemung or the Devonian.

Devonian System.

Two formations belonging to this system have been recognized in Ste. Geneviève, namely: the Hamilton Group and the Oriskany Sandstone. They were observed occupying a very limited area near the Big and Little Saline Creeks.

Hamilton Group.—This formation was found at only one locality, namely, on the Saline in T. 36, R. 9, S. 2, where it was examined by Mr. Hough, by whom it was described as a white and flesh-colored crystalline limestone, with fossils like those occurring in the Hamilton Group, near Wittenburg, in Perry county. Mr. Hough gives 25 feet as its thickness.

Oriskany Sandstone.—This member of the New York series has not been previously recognized in Missouri, or, in fact, in any of the western States. In Ste. Geneviève county, it crops out on Saline Creek, about four miles S.W. of St. Mary's. The beds present here a southerly dip of about 75°, and consist of nearly pure light-gray limestone, with a somewhat granular structure.

The fossils are *Spirifer arenosus*, *Spirifer** (*Orthisina*) *umbraculum*(?), *Leptæna depressa*, *Chonetes*, *Illænus* and *Lichas*.

Upper Silurian.

Lower Helderberg.—Mr. Hough found a thickness of 100 feet of this formation exposed in T. 37, R. 8, S. 1. I have not seen it in the county. Its lithological characters, according to Mr. Hough, are the same as in Perry and in Cape Girardeau.

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* This Spirifer is figured by Prof. Hall, with other Oriskany fossils in Pl. 97 of the 3d Vol. (unpublished) of the Palæontology of New York.

nishes the white sand so justly celebrated for the manufacture of the purer varieties of glass. Thickness from 30 to 80 feet.

The *2d. Magnesian Limestone* occupies a large area chiefly in the central and north-western portion of the county. If we draw a line passing south-eastwardly from the sources of the Isle au Bois to a point on Mill Creek, about a mile and a half above its confluence with the Aux Vases, and thence extend this line to the Saline, a short distance below the mouth of its North Fork, we shall have pretty nearly the line separating this formation from the Saccharoid Sandstone; west and south of this line, it ranges from one to three miles, forming, like the 1st. Magnesian, neatly rounded hills with gentle declivities.

The *2d. Sandstone* constitutes the surface rock over a larger portion of the county than any other formation; and it also presents a greater vertical development than we usually find in other counties of this portion of the State. It is constantly encountered on the high ridges at the sources of the Establishment, Terre Blue, Aux Vases, and Saline. We find it also occupying the highlands of nearly every section in T. 36 & 37, R. 7. The rock varies in lithological character in different parts of the county, but usually appears in thin beds of white, yellow, or reddish colors, and made up of moderately fine silicious grains. Near Cozzens' Mill, on the South Fork of the Aux Vases, a thickness of about 80 feet is exposed, and here the rock is curiously weathered into huge conical and dome-shaped masses that rise from 10 to 20 feet above the surface; some of them standing quite isolated, and others joined at different heights from their bases. In this vicinity, the rock occurs in heavy beds, and passes from a fine-grained sandstone to a coarse gritstone, containing large pebbles of milky and translucent quartz. North of this place and near Junca Creek, the sandstone is very much indurated and sometimes passes into conglomerate. On the Mineral Fork of the Saline, it is a coarse gritstone of a dirty, gray color, and contains galena and much sulphuret of iron. The thickness of the 2d. Sandstone, in this part of the county, may be safely stated at 150 feet, although we have not seen a greater thickness than 80 feet exposed at any one point. Nearly the whole pine district of this county is underlaid by the 2d. Sandstone.

The *3d. Magnesian Limestone* is principally met with in the cuts of the streams in the western and southern portions of the county. It is the prevailing rock of the North Fork of the Saline and its tributaries, throughout nearly their entire course. We find it also well developed on the upper part of the Establishment and its branches, and likewise in the headwaters of the Fourche à Duclos. On all these streams, it presents the usual lithological characters of the mass, frequently forming bold escarpments with mural faces, and sometimes exposed to the height of 150 feet.

ERUPTIVE ROCKS.

These consist chiefly of granite and green stone and occur on the upper branches of the Aux Vases, and near the Mineral Fork of the Saline.

Granite.—This rock differs but little from the granite exposed in the vicinity of the Iron Mountain. Felspar of the flesh-colored variety predominates greatly over the quartz and mica, and often the latter ingredient is entirely wanting. Sometimes, it is coarse grained, the felspar being immoderately large crystals, but at other times it possesses a fine texture, is quite hard, and may be dressed in almost any desirable form. It is best developed along the course of the Junca Creek, a tributary of the Aux Vases, being constantly exposed in the bed of this stream from the N.E. qr. of S. 2, T. 36, R. 7, to its very head. Not far from the lower extremity of the exposure, it rises in rugged cliffs to the height of 175 feet, forming here a narrow gorge through which the creek passes. At this place, veins of quartz traverse the granite in various districts. The largest of these veins, that I saw, was about four inches thick, and its bearing N. 20° E.

On the Middle Fork of the Aux Vases, the granite commences about a mile above the mouth, and may be traced along its course for a distance of about three miles, projecting above the surface in large dome-shaped masses. On the South Fork, it occupies a very limited space in the N.W. qr. of S. 25, T. 36, R. 7. Small fragments of red granite were also observed, scattered over the top of a high ridge about a mile north-east of Avon. The fragments thickly cover a space of about 80 square yards, and mark the existence of a granite dyke near the surface at this point.

Green Stone.—Mr. Hough found fragments of this rock, mingled with masses of granite, near the lower extremity of the granite protrusion on the Junca, but the direction of the dyke could not be determined.

ECONOMICAL GEOLOGY.

Lead.—The only mining for lead, in Ste. Geneviève, has been done at Avon Mines, owned by Messrs. Kaufman and Blackledge. These mines are situated in the southern part of the county, on the Mineral Fork of Saline Creek (Town. 37, R. 7, N.E. qr. of Sec. 12). The ore, which is a sulphuret, occurs in a thin nearly horizontal sheet, and is disseminated through coarse-grained dark sandstone of the age of the 2d. Sandstone of the general section. About five feet of this dark sandstone is exposed here, and it contains, besides the lead, nearly vertical seams of sulphuret of iron, and bands of yellow ochre. The principal workings have been on the north side of the creek. From Mr. Blackledge I learn that up to the time of our visit (Nov. 1856) these mines have yielded about 150,000 lbs. of ore, of which amount 16,000 lbs. were raised, previous to 1849, by the former proprietors, and the remainder, in the winter of 1849–50, and the fall of 1854, by the present owners. The lead obtained in 1849–50, amounting to about 85,000 lbs., was smelted at Mine La Motte; and there still remained on hand 60,000 lbs., which Messrs. Kaufman and Blackledge were preparing to smelt at a furnace recently erected by them, at Avon, in the vicinity of the mines.

Small quantities of lead have also been picked up in T. 36, R. 8, S. 31.

Copper, in the form of sulphuret, occurs sparingly with the lead at the Avon mines.

Iron Ore.—A valuable deposit of *brown hematite* occurs in T. 37, R. 8, Sec. 11, on land belonging to the estate of the late Col. Kaufman. The ore occurs in the 2d. Magnesian Limestone, and is to be seen in large masses, both on the summit and the declivity of a high ridge. A number of shallow excavations have been made here, and at nearly all of them more or less iron ore was encountered. The surface indications warrant the opinion, that ore of good quality exists here in workable quantities.

Another deposit of hematite exists in the same geological position on the summit of a hill, a short distance south of Avon Mines. This ore is very similar to that above described, and excavations should be made here, in order to ascertain the extent of the deposit. Hematite, in small quantities, was also observed by Mr. Hough in T. 35, R. 8, S. 7.

Sulphuret of Iron has already been mentioned as occurring in the 2d. Sandstone at the Avon Mines.

Building Materials of good kinds occur in nearly every part of the county. Among the carboniferous rocks, we have, at the base of the St. Louis Limestone, the oolitic beds, which are nearly pure white, and form a handsome and at the same time durable rock for building. The principal quarry is on the plank road two miles west of Ste. Geneviève; but it may be had at various other places in the neighborhood. The 3d. Archimedes Limestone, which is the same that has been used for the Custom House at St. Louis, may be procured on the Mississippi above Ste. Geneviève, and on the plank road near the oolitic quarry. The St. Louis, Encrinital, Niagara, Receptaculite, and Magnesian Limestones, all furnish material of more or less value for construction.

The 2d. Sandstone may likewise be employed for this purpose. It is also frequently an excellent fire-rock, being well adapted for the hearths and jams of chimneys and hearths of furnaces.

The altered Niagara rocks at James' Mill furnish a most beautiful variegated marble, which is susceptible of a high polish, and may be used for vases, mantels, etc.

For *Flagging Stones*, the 2d. Sandstone may be employed, and the 1st. Magnesian Limestone is at present used somewhat extensively for this purpose at Ste. Geneviève.

Silicious Gravel, for roads, occurs abundantly on the Saline, Establishment, and Aux Vases, and generally in a sufficiently comminuted state to be applied at once, without further preparation, to the grades.

Sand for manufacture of Glass.—The white sand, occurring eight miles west of Ste. Geneviève, has already been described. This valuable material may also be obtained on the Kaufman estate, in T. 37, R. 8, S. 23, and at other points along the out-crop of the Saccharoid Sandstone.

Saline Springs.—The brine springs of this county are found chiefly on Saline Creek. They occur along this stream from the mouth to a point about two miles above, appearing at intervals of from a few yards to a quarter of a mile.

They issue from the base of bluffs composed of Archimedes and St. Louis Limestone, which sometimes reach the height of 150 feet. Some of the springs are highly impregnated with saline matter, and bubbles of sulphuretted hydrogen constantly escape from their surfaces.

I am informed by Mr. Pratte of St. Mary's, who kindly accompanied me to the Salines, that salt was manufactured here to a considerable extent while the country was under the Spanish Government. Up to the year 1812, they were known as the "Pérouse Salt Works." Subsequently, large quantities of salt were annually made at these springs by Messrs. Scott and Hempstead, from whom they were purchased by Gen. Dodge, who continued the manufacture with considerable profit until the year 1820, at which time the works were abandoned.

In mammals, the gustative or hypophysial, and optic or chiasmal block-pieces are distinct from the rest, and underlie, precisely, their respective flank-slabs, while in Fishes the first or condylar and the last or olfactory bases remain isolated, leaving the auditory side-slab's block-piece as (an arithmetical) remainder. The flank-pieces to the 5th, or olfactory cranial vertebra, are the ethmoidal bones, in Fishes overarched by a platform sutured with the frontal bones, that presents the lamina perpendicularis ethmoidalis as its vertical continuation, meeting the block from above and by a suture. In amphibia, birds, and mammals, it is gradually overlapped by the expansion of the frontal bones and covered with the facial ossa nasalia; so that, ultimately, in Man, it only exists as lamina perpendicularis ethmoidalis, with the *rostrum sphenoidale* for its block; thus proving that 5 *complete neural arches participate in the formation of the cranial cavity*, besides the temporals.

Extremital Fabrics.

In many Fishes, both pairs of extremities are congregated with the facial and maxillary ones at the *head*. Like the cranial vertebræ, they are *five* in number; a foremost, pterygo-maxillary, *palatal* one; a masseteric or temporal *mandibular* one; an opercular *hyoid* one; a *scapular*, and a *pelvic* one. All are after the same type, consisting of a glenoidal, tripartite, extremital fulcrum, a humeral, two ante-brachials, and a rayed hand or *fin*. The extremital fulcra consist each of a blade, a bar, and a (coracoid) brace,—the *fulcral tripod.*

Of the pterygo-maxillary extremity the swan's skull offers a fine exemplification: a strong, pterygoid *bar*, by its posterior prong *implanted into the glenoid cavity* as in Fishes, bears a slender, zygomatic *blade*, is backed by a styloid *brace*, and bears a pterygo-internal humeral, meeting at the otherwise naked skull-base from either side, and from this elbow gives issue to an external antebrachial or *palatine* bone, and an internal one, fusing with that of the opposite side in the median lines for a *true vomer*. The latter is always a doubled bone, and is produced by the mutual connivence of palatine antebrachials, but is never to be found at the base of the fish-skull, the inferal median ridge whereof is indeed the *nasal block*, or true *rostrum sphenoidale*, with lateral sesamoids, often expanded as *true intermaxillaries.*

The fin or hand to this extremity we find in perfect likeness of a bat's hands, in the lake muscalounge (masque-allongée, Esox sp., length 5 feet). The interior ones, agglutinated to the nasal vertebra, constitute the *nasal bones* of the face; the stout second forms the *true maxillaries*, with teeth, like the nasal base inclusive of sesamoids; the third, a finger of five bones forms the infraorbital osselets, in likeness of a cartilaginous *nostril-wing* surrounding the jawless orbit; the fourth is a long arcuate beam, with a terminal phalanx agglutinated, a *labial* forming the outline mask-bone of the upper jaw; and the fifth or thumb, a labial *stump* as the thumb of bats and birds. The numbers of digital phalanges, as of cyclar elements, may vary among the different cyclar numbers.

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As, in Fishes, the pterygoid tripod swings on the temporal one, and the proper extremities of either are agglutinated at the palatal elbow, so the hyoid tripod, likewise, is agglutinated behind the former, forming the *tricompound opercular valve*, a conchiform blade underlaid by an ensiform one and a more or less uncinate one at the forward downward angle. Throughout Fishes, these three are seen to assume a homogeneous development among themselves; being ossified in the sturgeon, while the surrounding bones are cartilaginous, etc. Oken and St. Hilaire claim this triad as the *auditory ossicles*, and, indeed, in the swan the tympanic bone still bears the traces of its opercular-lidded origin; like it, presenting a pterygoid articulation, and a quadrant expanse, backward; these ossicles, coalesced in birds, forming into a sort of porus tympanicus at the skull base, without the connivence of the sinuate-furcate temporal bar which in Fishes encircles the cranial obturatory hole, the "meatus auditorius externus" proper of mammals.

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NOTES ON COMPARATIVE ORGANOTAXIS.

BY T. C. HILGARD, M.D.

"Memento, quæso, quod sicut lutum feceris me, et in pulverem reduces me. Nonne sicut lac mulsisti me, et sicut caseum me coagulasti? Pelle et carnibus vestisti me: ossibus et nervis compegisti me."—Job. X. 9–11.
"He cometh forth like a flower."—*Ibid*, XIV. 2.

AXIAL OR VERTEBRAL CYCLES.

Above all, it is necessary to identify the single parts in different classes of Vertebrata, without which it would be impossible to give an intelligible and harmonious nomenclature and comparative descriptions.

What in Mammalia is simply the vertebral block, in Fishes presents, First, a central cartilaginous mass, cylindrical in cartilaginous, hour-glass-shaped in spinous Fishes; Second, two lateral ridges, in the Percoids prolonged into long cross-spines resembling sawfish-teeth and supporting the ribs; such are, no doubt, the sesamoids inserted into the nasal block-piece of Bubalichthys, serving for the lateral articulation of the small inter-maxillary bones; and, most probably, the pair of loose internal ear-stones (otolithes) contained in the cranial cavity of Fishes, within the second pair of lateral segments; and the eye-lenses, calcareous and pisiform in Fishes, resembling sesamoids, as it were, of the opthalmic vertebra; Third, a pair of inferior ridges; the ridges leave deep dimples between, filled with soft tissues. Therefore, Oken, the father of philosophical anatomy, after Goethe, who gave it the first clue and vital impulse of *idea*, so long rejected by a dominant *savantisme* rather destitute of it, gives this proposition in his "Naturphilosophie," § 2111: "The vertebral block is not a simple vesicle, but is itself quite a compound osseous system." I came to the supposition of its being an organization numerically independent of the arches' components, because supernumerary to otherwise regular, cyclar numbers of the latter. Each block-stone's original elements, indeed, can be conceived as a cycle of 5, with the cartilagino-vitreous disc or vortex as the odd and progenitorial element, and preserving the position at the end, rather upward. In the first or condyloid vertebra of the cranium of Bubalichthys, the cultriform block is posteriorly augmented with a bulbous exostotic wire-work, probably its pair of "inferior ridges." The auditory, gustative, and optic (the petrous, great sphenoid and small sphenoid) wings, being *side-slabs to as many complete cranial vertebræ*, are underlaid by horizontally alate expanses of three ridges, the auditory ovate-lanceolate, the gustative retrorsely trilobous, and the optic gradually tapering forward, and all of *different heights;* thus proving their tri-farious origin, although ultimately fused by means of their very expansion: in the nasal block, however, sutured from the rest as in the condylar base—likewise *free*—and occupying the *distal* end, hence without effecting an interbasal fusion as with the 3 medial ones.

Segmentation of Cranium.

Two pair of similar ridges for the adhesion of muscles mark the basilar bone of the human cranium, and, in confirming the existence of *two* segmentary blocks instead of *one* as received from Oken and others, are borne out by the incumbency of a condylar and a petrose side-slab respectively, the top pieces of which, forming the occipital squama in Man, although fused in the median line, yet preserve the transverse partition visible in the new-born human skull, the partitions corresponding exactly to the eminentia cruciata, protuberantia occ., and linea semicircularis superior; the transverse occipital suture being also preserved in the infant and adult skull of ancient Peruvians [Tschudi], in the young cat, in rats, mice, and in the young sheep, where it even presents an intercondylar *median suture.* In the cat the anterior segment takes a triangular shape, point forward; in the musk-rats, squarish. The cross-suture, forming the dividing ridge between the nuchal or trunk-muscles and the galea or facial ones, encircles the occipital steep. In Fishes, the originally quadripartite occipital squama, is orbiculate-rhombic as in Man, or rhombic; small, for being *repelled* on all sides, while forming the *cruciate fulcrum* between the cranio-facial expansion, before, and the truncal, aft; strongly cross-crested with an external eminentia cruciata and of rectangular profile, as the porcate-gabled and cruciferous, diamond-shaped corner-stone (Owen's "key-stone") of the cranial masonry. Thus, the rhombic bone in question is by no means a supernumerary to an ill-construed first, but the requisite cruciate *roof of the two first* belts (a condylar and an auricular), separated from their respective side-slabs by the horizontally intervening temporal which are inserted into the crevices of the skull [Cuvier], and not included in the vertebral segmentation proper, and hence are supernumerary to its vertebral elements; the cornered diamond being underlaid by a crescented *mastoid;* the parietal or gustative top-plates by the exsinuated *meatus*-bone; and the frontal or optic ones by the *prong'd squamose* element of the temporal glenoidal triad.

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Under the opercular bones of Fishes or (true) tympanic ones, proceeds a strong down and forward hyoid beam, of five parts properly, and *bearing the infra-opercular fin for its hand*; the palatal, mandibular and hyoid hands being agglutinated—briarean, like the forearms of Hindoo divinities—at one common focus. It is therefore not a matter of surprise to find also the scapular and pelvic bones, in Fishes, agglutinated and mixed, as it were, in a similar manner; the scapular arch, behind the gill-slit, in its symphysoid form not only presenting on either side a true scapula, an ischioid clavicle, encircling an obturatory hole, and a posterior styloid beam or ray as an uncinate element, (compare chicken pelvis); but likewise, in the two superior connective slabs, sometimes pronged (not the *agglutinated pelvic Cones*, supernumerary or "divided shoulder bones"), the vagrant anal fins (often adhering to the pectoral ones) being their true, but *otherwise hipless*, lower extremities! The fulcral constituent parts are three, a phyllotactic number. One humerus, 2+antebrachials=3; 8 carpals and 5 metacarpals are 13. There are, besides, five fingers to the hands, and toes to the feet, each of two or three elements: 1, 2, 3, 5, 8, 13, etc., are phyllotactic numbers, expressive of individual, and, perhaps, variable cycles.

Spinal and Hæmal Arches.

The fish-head, bearing testimony of *five* pair of extremities, and *five* vertebral belts, and, backward, divided from the body by the diaphragm, contains not only the *heart*, but likewise in the *quinal* number, the branchial arches, and on them the tasseled or papillose branchial membranes, corresponding, probably, to the auditory ones of higher vertebrates; this mucous membrane, not yet joining the auditory capsules, or canals, contained in the skull, but still being subservient to respiration; as with insects the eyes likewise are destitute of a conjunctival sac, the like of which as well as of the branchial sacs, we find, as respiratory, (at least tracheal) ones, subservient to volitation or air-beating, in the *wings of insects.*

The branchial arches consist of a median sternal phalangoid segment and two lateral cartilages followed by a costal arch-blade on either side, in perfect likeness to the thoracal ribs of higher vertebrates, and like which each bears an incurved capitulum or clavicle, and a retrose uncinate process, as strikingly developed in Pimelodus (cat-fish) resembling the capitulum and tuberculum of true ribs, as well as the anterior capitular and posterior uncinate socket processes of spinal and cranial arches. In the cranium of Bubalichthys (buffalo-fish) the uncinate ones of the condylar vertebra form a pair of loops or handles, as it were, caught in a notch of the ultimate nuchal top-slabs.

The posterior elements of the branchial arches are seen in the Cat-fish and White Perch (Corvina oscula, Les.) to transform their lower halves into a *thyreoid*, the upper capitula, etc., into *arytenoid* bodies, in the latter, of great thickness, and paved with depressed globular teeth, as a sort of faucal forge, squeezing the contents down the gullet, which is the immediate continuation of the branchial (or pharyngeal) cavity.

The tripodal development into a *blade* (rib, shoulder-blade), a *bar* (capitulum or clavicle) and a *brace* (tuberculum or coracoid) with phalanges a diaphysis and two apophyses, is, then, *a feature common to all costal and phalangal as well as fulcral extremital elements*. It is an individual trinal phyllotactic development of farther accessories, a *whorl of itself*, as it were, and sometimes it seems reduced to fewer (1 or 2) elements (all of which are typical organotactic numbers), in the piscine antebrachial palatals perhaps elevated from 2 to 3 or 5. In fetal development these groups form distinct glomeruli of osseous centres—remaining thus clustered in carpals and tarsals, the branchials of moles and Fishes, etc.

This assumed, the branchial, hæmal and spinal arches equally offer this uniform structure: two frequently tripodal flank blades, or ribs; one sternal element, ray, or spinal crest-cartilage; and a pair of connecting pieces, being the rib cartilages of higher vertebrates and of the branchial arches and the doubled dorsal and ventral poniards of Fishes, and, in the cranium and spine, the top pieces, making, *ribs, cartilages and crest, five for each arch*, the odd (uneven numbered) one being turned downward in the hæmal fabric, but upward in the spinal as well as in the axial or block-stone cycle. The ensiform lateral appendages of fish ribs, as in the birds, are the retrorse tubercular processes of the rib-blade.

Now to account for *three collateral quinal cycles* repeated along the axis, or forming the same.

In the bilateral or ringent, labiate, personate, spurred, type of flowers, each cycle being known to *deflect from the axis, and in the sense of the odd*, the cycles, (calyx, corolla, anthers, pods, seed), holding an alternate position to each other, it is likely this osseous fabric (exclusive of extremities) likewise represents a column or tree of vortices, *each of three ringent concentric quinal cycles*, an axial, a visceral, and a neural one, alternately deflected.

Floral Cyclosis Five-fold.

The five floral cycles above mentioned have these functions in common with animal structures: the calycine, or in carnified epigynous fruits, the flesh-lobes are *digital*, and their gemmal structure is that of the Moss type; the powerfully erectile injected corolla is *branchial*, and its aqueous structure is that of Algæ, the "flowers of the sea"; the anthers are pulverous, *cytosporous*, emitting or exhaling the specific, or fecundating, principle, "reduced to dust" in the shape of the desultory and medullary *cell*, the type of the Fungus-propagation, beingthe commencement, as fermentative cell, of Organic life. The fourth is the *utricular*, vesical organ, or capsule, dry and ocellated as Lichens; and the fifth, or *seed*-cycle, in the convolute seed and circinate stigma, recalls the lobed and circinately convolute Fern as well as fetuses.

The quinal number and successive alternation and consequent coincidence of each two post-proximal cycles are beautifully illustrated in a delicate cross section of the apple, the "Rose become Flesh," as it were. No longer in a floribund state, with the floral organs still visible at the apical coronet, the apple presents a central morning-star of five *capsular utricles*, enclosing *fociferous organs*, or seed within, and radiating the flesh-ribs, the occult bases of the coincident *petals;* and imbedded between its rays, a turban'd bunch of tuberously crescented *antheral bases*, capped by the broadsides issuing into the *calycine* lobes of the coronet.

A similar quinal arrangement, alternation, and functions, as qualified above, we find in the epidiaphragmatic fabric or bust of vertebrates, condensed in the fish-head. The fetal proboscidal, buccal, and mammal *lobes* are known to gradually converge and close up into the nostrils and mouth, the apical coronet of this quinal fabric. If incomplete, the monstrosity of the hare-lip remains, a fissure between the proboscidal and buccal lobes on either side, never in the centre, as continuations of the nostrils, or eye-sockets.

In each of the primordial facial chasms we find imbedded as many "*brànchial*" or mucose membranes, the conjunctivæ in the sockets, the Eustachian ones in the branchial fissures, and the buccal one in the intermammal or median fissure, developed in the specific-nerved tongue and fauces [Proc. Am. Ass'n, 1854, p. 248], and with the lip-seams, like notched rose-leaves, coating the intralobal fissures.

In the same chasms, by binalternation coincident, might be recognized as many profound *utricular* elements: the eye-ducts; the acoustic or interal ear-ducts, with helices and semicircular canals; and in the median line, like the incumbent tongue, the heart, each containing liquid and focal matter; the eye-ducts, tears, and the optic system, on which expands the optic nerve; the auditory utricles, on which themselves unfurls the acoustic nerve, the Liquor Cotunnii and otolithes; the heart contains the serum and blood-corpuscles, the vitalizing seed of the whole body, the highest and most central of cycles. The stigmatic issues of the heart are the vascular systems.

In coincidence with the carneous lobes we find these *cytosporous* or bilobous glandular organs: with the thoracal lobes, the mammal glands; with the buccal, the parotideo-sub-lingual salivary glands, as two lobes; with the proboscidal one, the bilobously sinuoso-cavernous, glandular Schneiderian sac, a true acinose gland, and on which the specific olfactory nerve expands. By repetition of the cytosporic (antheral) cycles so frequent with flowers, a second glandular cycle, alternate to the former, becomes incident to the branchial membranes; the lachrymal glands to the conjunctivæ, the tonsils to the Eustachian membranes, the lungs to the intermammal or buccal mucosa. All five branchial laminæ or mucosæ (as insects wings, araneal branchial sacs, and piscine conjunctivæ) are originally isolated, but (as in tubuliferous flowers) in the higher vertebrates become confluent at a common *fauces* (a botanico-zological term of comparative morphology.)

The separation of the face and head from the thoracal structure is due to the osseous development independent of the visceral cyclosis above detailed.

If we designate the cranial vertebræ by the ordinals in ascension, as the visceral cycles they supply, the *motor* condylar, with the medulla oblongata, is No. I.; the auditory, with the Pons Varolii and cerebellum, is IV., supplying the auditory helix of the *utricular* system; the hypophysis-bearing sphenoidal belt is II., supplying the *branchial* or mucous system in the tongue; the chiasmal, optic belt is V., supplying the focal system with its specific nerve; the olfactory, ethmoidal is III., supplying the *glandular* system in the sinuose olfactory sac.

In the ascending order of the visceral cycles, also, historically originate their respective cerebral segments, so that in fetal development the cerebellum, or fourth, is actually interpolated between the medulline first and the hypophyseal second; and the optic thalami, as the fifth, between the hypophyseal and olfactory.

I., IV., II., V., III.—How is this linear succession of vertebræ to be explained?

My proposition is, that it offers exactly the same succession as the peripheric one of quinal cycles, the late comers being actually contiguous to their supposed proëvals.

A similar arrangement we find in the (as it were) overwelling, osseous cycles on either side bordering the rays of star-fishes. The three largest in size, sucessively decreasing, fall into nearly the same plane: the tesseral fourth and poniard-like fifth are lodged anteriorly on the *interstices*, and if, by secedence of contiguous ossicles, *admitted* into the crevices, would exactly follow the same order as the cerebral and cranial segments.

Below the diaphragm, we find a ternal cyclosis, in organs corresponding to the upper, and in functions partly identical with that of the flower, viz., in the function of *generation.*

The upper system is *ingestive*, and the extremities, derived originally from the cranial fabric, and lodged in its lobes, the palatal, mandibular, hyoid, and brachial extremities, are all alike *prehensile ;* while those lodged in the lower, or eductive visceral cyclosis, the legs, are accordingly *repulsive* in their actions.

The *carneous* triad of the eductive system are the conjugate hips and nates, with the scrotal or pudendal lobes for a coronet, and the odd (single) ascending diaphragm and descending abdomen with the prepuce for a coronet. Each of these carneous lobes caps a primary and a tertiary gland, coincident by binalternation; the diaphragm with the bilobous liver and pancreas; the hips or nates with the bilobous kidneys and suprarenals. This supposes an intervening secondary glandular triad to exist, and which, hence, must be coincident in position with the branchial or erectile laminæ: the conjugate ovaria (testes, by embryological identity) with the erectile alæ vespertilionis (also extant in male rodents; the conjugate corp. cav. penis in Man); and the odd spleen coincident with the odd, doubled labium pud. internum + vagina (= corp. cav. ureth.), a convolute branchial element, in likeness to the orchidaceous labellum and inserted between the nates lobes by alternation. To this series must be coincident the utricular, stigmatico-appendaged cycle likewise; the conjugate womb-segments, and the tubæ as their absorptive appendages, with the alæ vespertilionis and ovaria; and the urinary utricle, and fetal allantois (placenta?) as capillary suction-sponge in the odd or anterior position, with the vagina and spleen.

The embryo, indeed, corresponds to a seed; the womb, to a bipartite capsule; the ovaria (or, in the male, testes,) to the cytosporous anther; the erectile laminæ, to the erectile petals; and the carneous lobes, to the confining flower bud. The trinal type dominates in the monocotyledonous or lily tribes; the quinal terminates the dicotyledonous series of floral forms in Pomaceæ.

Somatic Strata, Visceral Cycles, and Cryptogamæ.

The *cytosporous* or cell-shedding, pulverulent cycles' function—the fervid and vital, fermentative and effervescent action—,we find largely and emphatically represented in the diffuse, cytogenetic, and, *par excellence*, eremacaustic fungine thallus, mouldy, pervasive, katalytic, chafing and consuming, under the form of fermentation, the noctilucent decay of wood and of putrid decomposition. Like the central caloric of Earth, it inhabits the *bulk* of substances. In animate organisms, we find its function repeated in the (fermentatively) specific action of cellular contents, of the glands, olfactario-intestinal crypts, the brains and ganglia, the fat and marrow. The nerves supplying organs once severed, says Reclam, the specific action of glands becomes tempestuously paramount, producing heat and excitement; a proof of the inherency of bio-chemical action in the glands, while to the nerves, brains, and the ganglionic masses, belong the specifically *bio-dynamic* energies. The antheral process of fructification in Aroids is known to produce considerable heat. The sudatory mucorine spores, like a moist dew, fore-fashion perspiration; their fermentative exhalation of carbonic acid gas, respiration. The mealy favoid crusts—as of Favoideæ and fermented cheeses—resemble fat-cell deposits; the psaltered and honeycombed pilei of Agaricinæ resemble the radiate-psaltered olfactory crypts (of cartilaginous Fishes) and the psaltered and honeycomb-crypted intestinal surfaces. The Tubereæ tuber, or semination, resembles (lymphatic) glands and marble-veined cerebral lobes, and the immersed nucleolar one of Sphærieæ resembles the ganglia and the Peyerian plaques of the intestine.

The *aërifero-membranous*, ocellate and reticulated, dryly fibrous, pod-leaf character of Lichens we find repeated in the aëriferous, ovuled capsules, the utricular cycle of flowers. The skinny, reticulate, digitate and finger-nailed Peltigereæ figure the cutis; the desultory Ramalinæ, the fascial type; the digitate-gloved Cladonieæ, the digitate membranes or ramified hose of glands and vessels. The abode of Lichens is dry and airy. Their gristly, cupulate semination is as the cartilaginous cupules and enamels of the body, and is also in likeness of the fungus-pilei and napelli, all sporangial formation being fungoid.

The *scatent*, buoyant, injected Alga type, we have recognized in the petaline cycle of flowers and the erectile and mucous branchial laminæ of the ingestive and eductive visceral cycloses. The scatent fibre, or tissue, is the conducting fibre and vessel, while its globulous convolutes rather represent its semination (of fungoid substance). The lymphatic intestine may be claimed as the especial and individualized representative of Algæ, which have the branchial or mesenterial forms likewise, and the *sporangia* whereof (pulverous, fungoid tissue) are the lymphatic glands, similar to the accumulated crypts of Fucoids.

The tesseral, *incrustate-cancellate* type of Characeæ, Diatomeæ, Chlorococceæ, Sphagneæ, Bryoideæ, Hepaticæ, Lycopodiaceæ, and Equisetaceæ, which are calcareous, silicified, jointed or candelabrous, and annelido-crustaceously segmented, is repeated in the osseous, digital and loricate, tissues of Polyps, Anthozoa, Segmentata, Conchifera, and Vertebrata, class-divisions sufficient for the present purpose. It is the incrustative or *Moss* type, the one which in its primeval stone-coal and modern peat-ledges affords the semblance of a living and crescive bone and crust of the globe.

The *spiral* element, introduced by endoplastic incrustation, in the seminal organs of Hepatics, is further developed in the Fern tribe, which, supported by the strength of the incrusted fibre following the spiral vessels, uprears itself out of the captivity of the specific element to which the four prior classes are addicted, and luxuriates only in a free concourse of these four: damp, earth, light, and air—emphatically the state of the carboniferous climes of by-gone ages.

The specific differences of these developments are evidently based on these four specifically different elements of the cell and epochs of cellular life: the *medullary nucleus*—nitrogenous, cytogenetic by partition (Schacht), self-revolving within the cell-membrane (H. Mohl), the central and vital motive fervor of the cell. It next produces a delicate confining membrane, (different from the later ligneous endoplasms), of pure cellulose, and, with it, the *vacuole* or internal cell-atmosphere. This period is the aërifero-membranaceous. The vacuoles, expanding, confine the creeping nucleus into costate beams centering in the nucleolus, and on them stream the now apparent streamlets or internal *cell-rivers*, indicative of the neptunic phase of the cell. Then gradually is deposited the cavernous, dotted, reticulate and spiral incrustation, rendering the cell perfect and independent of an uplifting, circumambient, elementary homogeneity or ocean.

Of all the tissues of animals, the muscular one alone remained as yet unaccounted for. In it, we find the fibre fascicled, as in Ferns, and *spirally vittate ;* and as the muscle contracts when its nerve is electrified, may it not be that this is due to some vital electro-magnetic action? For if it be the *spiral* that becomes electrified, then there is a magnetic axis in the fascicled fibril wires; and if a magnet be supposed elastic, as in the case of fibrils, by polar attraction, it must *contract in the axial sense!*

Electro-Magnetism the Type of Cyclosis.

Organotaxis, pervading all the living kingdoms, is manifest as an efformative *spiral progress around an axis.* In this we have the strongest similitude to the electro-magnetic phenomena. If it be that electricity must be considered the motor of chemical action, then a vitally and specifically predetermined electric potency must be claimed as the motor of organic combinations and hence of organs. And as its activity becomes manifest in a centered coil, then the plausible explanation is, that there is a *pre-existent bio-magnetic constitution.* [See "Weisungen mos. Schpf.," Wien. pr. M. Auer., 1855, W. 68, p. 73, W. 116, p. 165. "Naturmagnete."]

In the ossicles of Asterias, we see a spiral development of ossicles or bones, in the fashion of vegetable cycles. In the cranium, the peculiar interpolation of cerebral segments suggests a circinate development, the element following the peripheric order, as if a *cycle* of five was *ruptured* and extended, between the first and third element, much in semblance of a *crosier-head*, likewise devised of radial elements, or leaves. According to my explanation of Phyllotaxis, so favorably received by such authorities on the subject as Profs. B. Peirce and L. Agassiz, this phenomenon, like that of *warp*, produced by the axial prolongation yielding to interpolations, while fixed at base, is also explicable, under my proposed idea of organogenesis, by committed prolificacy (Prc. Am. As'n. 1857, P. II., p. 84), or, perhaps, "change (circuit) of generations" of modern authors. The fourth element, then, would spring from the first, the fifth one from the second, and toward its oldest neighbor, the which is to be effected simply by the distance, or repulsion, between the extant elements, *admitting the new elements into the axial interspaces*, deficient in the coercively centralized buds! A repulsion in the axial or magnetic sense, or, the want of peripheral or electric circulus (rupture of electric sphere? Wsgn. W. 68, p. 81) would suffer the elements to assume an axilinear interpolation and hence without radial divergence.

Relations of Organs to Animal Orders.

It is only in Vertebrata, that the conjunctiva enters into the composition of the eye, and the eye becomes movable in the socket. It might be said, they are characterized by a *perfect eye.* The eye is the representative of the seed or focal cycle, forming the centre and climax of floral as well as visceral cyclosis. If we proceed backward, we next find a vast class with a perfect development of the vascular system, not met with in lower classes. These are Cephalopods and Conchifera, rather ambiguously and improperly called "Mollusca." It is the *heart* which is developed; also, the vascular or *utricular system* throughout, comprising the womb, bladder and cephalic capsules or utricles, like which we find a huge development, as of a helix, in the helicine valves, and in shells in general. In the segmented animals, naturalists have always been struck with the *tracheal* developments pervading, in insects, the whole bodies, and provided with pneumatic valves or so many pumping nostrils (compare frogs' nostrils) all along the sides of their bodies, chiefly consisting of a (respiratory) gland, and, in the undeveloped state, constituting but a huge, segmented, glandular mass, whence the spider-net and cocoon are spun out. The insect-head seems to be destitute both of a true vitreous mass and cephalic utricles. The proboscidal or frontal lobe is segmented into a head, and, together with the thorax, is representative of the quinal bud or carneous fabric of the bust, harboring in its chasms, devoid of vitreous mass and utricles, nothing but the branchial system of wings so often remarkably imitative (e. g., in butterflies and our ocellated Attali) of the configuration and features of the human conjunctiva, cornea, pupil, etc., (compare, in Paul Delaroche's Napoleons, the *orbital coves*). The *branchial* or *petaline* type has already been noticed in the vast class comprising anthobranchiate, laminoso-tasseled Medusæ together with Polythalamia, thence called Anthozoa; while the sea-anemone and reef-building Polyp tribe (if polypus be derived from *polys*, many, and *pous*, foot, then Polypods would be correct) together with Asterida and Orinoidea are expressive of endocrustation, the osseous fabric or the candelabro-digital type.

Elementary or Specific Qualities.

It is an ultimate object of explanatory research, or inductive science, conceiving of laws, or *explanatory expressions* for the phenomenal *statements*, called facts, by gradually divesting the phenomena, as much as ingenuity can devise, of their common features or conditions, ultimately to arrive at certain fundamentals, which, *admitting of no generalization*, are hence inexplicable, constituting the fundamental specific conditions; out of which, by universal causation, might arise all the ultimate differences, relations, and phenomena as their *consequences* (Lectures on Pot. Physics, by B. Peirce, Prof. Math). The study and knowledge, now-a-day's so much neglected, of the subjective operations of the mind, itself, would alone be likely to discover an all-sufficient procedure and unerring system of explanatory research, teaching *how to proceed systematically* (Vol. 1, No. 2, p. 128, Seherg. p. 64) and where to terminate.

To the observable four fundamental cell-functions, organs, tissues, classes, etc., and a fifth one comprising or subsuming all, the traditional Elementary Doctrine (Weisungen etc., above p. VIII., 169, W. 116) affords a clue, inaccessible except through the mind, because beyond observation.

We have seen, that the alternation of cerebral segments: I., IV., II., V., III., is a cyclotactic consequence of this direct ascension of the sensuous Cycles: lobate, branchial, cytogenetic, utricular, lenticular and of which, if numbered after the ordinals of the succession of their corresponding cryptogamous classes, the order would be (calyx, corolla, anther, pod, seed) IV., III., I., II., V. The Elementary Doctrine [*ibid.*] appears to me to furnish a clue to this *succession*, "attraction of elements" proceeding from the gravitant to the fluxile, thence toward the lucent, thence toward the motitant. And the same idea at once explains the radial *alternation* of cycles; alternation being *approximation*, in quincunx, and their oppositions, repulsions, *incumbent and incubated.*

Number of Vertebræ.

Respecting the number of superimposed triads of cycles composing the axial osseous fabric, we have seen not only the number, but the interpolations likewise, of cranial segments to be in the *phyllotactic form*; hence, probably, their respective primordial cells were produced as a circinate cycle, in the vertical plane, in the embryonic cucullate hood. The number of somatic vertebræ, including the ultimate coccygal cartilage (in Man), is 34, a high phyllotactic, organotactic number. The coccygal cartilage presents but the primordial vortex of the vertebra from which the other elements would, organotactically, be derived; the coccygal cartilage remaining on this *primordial costal stage*, and being either the first or the last link of the segmentative fabric. This moniliform connecting link between the collateral cyclar structures, and in Medusæ, the segmentative rotuliferous buds of their polypiform larvæ, are most probably the prototypes of columnar segmentation into radiate organs, in the vitreo-gelatinous condition of the embryonal mass.

Sensuous and Moral Organism.

As our moral sentiments cannot, in the common physiovigil state, be made manifest from individual to individual, we are obliged to use physical figures, in which we expect all to recognize the corresponding moral functions. In all languages, perhaps, the sensous faculties are held as parallel to certain moral ones, which are, synonymously, or symbolically, expressed thereby, such as *feeling*, in both a physical and moral sense consistently carried out in such figures as *moved*, *touched*, etc., referring to sensations compared with corresponding *sentiments.* We use *taste,* also, in such parallel significations. Taste comprises certain tactile sensations, such as acerbity, pungency, etc., and the host of aromatic or olfactory sensations (Proc. Am. Ass'n, 1854, p. 248), besides the specific or *exclusively* gustative ones of sour, salt, sweet, bitter, etc. In this tricompound occurrence it symbolizes, by common appreciation of humanity, the sphere of agreement or assimilation, the *rate* of appreciation, as it were. The nostril, as representative of the respiratory and olfactory function, in natural language implies the active pathos or fervor, *Trieb* (Germ.) or *passion* (French), the faculty of *active desire,* to which, indeed, the whole glandular system, the lungs, salivary, lachrymal, digestive, eductive, and sexual glands are subservient. Audition, the German *Vernehmen,* whence *Vernunft* (reason), *entendre,* Fr., is receptively susceptible like understanding, or *Intellection,* and Vision (*cernere*) is emblematic of discrimination, or concentration under a focal point of *view—Judgment,* as it were. These three latter vital energies, Desire, Intellection, and Discrimination, are somewhat insinuative of the traditional triad (above, *W.* 6—9) of the anthropomorphous Mind (voluntas, memoria, judicium), the latter proceeding from the two former; that is to say, from the purport of the question, and on the evidence realized, the judgment is passed; which fundamental form, or *type of cogitation,* is symbolized and manifested in the form of the *algebraic equation,* magnitude being the understood *purpose,* the concrete values the *evidence,* and equation (equity) *judgment,* as it were.

It is not improbable that the mental functions, thus, by universal intuition typified in sensuous perceptions, may yet be found to have their physical prototypes in the corresponding floral phenomena; as the whole assimilative, eductive, regenerative and generative *activity* as well as the cerebral nuclei, stand in anatomical and organotactic relations to floral cyclosis, so that, indeed,

> "*Da, wo die Menschen streben*
> *Ist Mensch der Blume gleich.*"

Perhaps it is thus, that physiological botany may bid fair to become the clue (to a certain extent and if harmoniously applied) to both sensuous and moral psychology, conscious life being of an organic, *generatively intentive* and not merely of a passively susceptible or inert nature. In Fungi, fermentative and catalytic, as in the anther, *generative fervor* is manifest; in Lichens and the capsular placenta as well as in the skin and the womb, *female irritability;* in buoyant Algæ, flushed petals, tongues, erectile lobes, *masculine emphasis, enunciation, language;* in Mosses, calyces, and the carneous lobes, as in vertebral cylosis, and in the plumule, *generation;* in the Fern and seed, *evolution,* development.

TWO NEW DIŒCIOUS GRASSES OF THE UNITED STATES.

By George Engelmann, M.D.

The grasses, though usually hermaphrodite, show a tendency to a separation of the sexes, and polygamous flowers are not rare among them. About 25 to 28 genera, one-twelfth of the whole number known, comprising only 75 to 80 species, about one seventy-fifth of all species,* are described as having monœcious and mostly heteromorphous flowers.

Only two genera of diœcious grasses are known to the books; of these, *Spinifex*, Lin., with 6 species from the East Indies and Australia, bearing on some plants staminate and on others complete flowers, is only incompletely diœcious; the other genus is *Gynerium*, H. B. K., with five South American species. Some other diœcious species of genera, generally hermaphrodite, are noticed; such as *Calamagrostis dioica*, Lour., and *Guadua dioica*, Steud.

The unisexual grasses mostly belong to *Oryzeæ*, *Phalarideæ*, *Paniceæ* and *Rottbœllieæ;* none have been known among the tribes of *Stipeæ*, *Agrostideæ*, *Chlorideæ*, *Avenaceæ*, *Festuceæ*, and *Hordeeæ*.

They were unknown in the northern temperate zone, with the exception of *Zizania* and *Tripsacum* of North America and the cultivated *Zea*, all with heteromorphous staminate and pistillate flowers on the same plant. The diœcious grasses of our Flora are both species of *Brizopyrum*; † *Eragrostis reptans* is also frequently or mostly diœcious, and other species of this genus seem to be imperfectly so.

In the following pages, two new diœcious North American grasses are described, both types of new and very distinct genera, and both, it is believed, belonging to *Chlorideæ*.

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* In the latest work on Grasses, *Steudel's Glumaceæ*, published in 1855, about 6,000 species of Grasses are described, very unequally distributed in about 800 genera, many genera containing only a single species, while *Panicum* alone comprises 864, *Andropogon* 461, *Eragrostis* 247, and *Festuca* 239 numbers.

† *Brizopyrum spicatum*, Hook, is from the eastern seacoast, and *B. strictum*, Torr., from the saline soils of the Missouri region and of Utah. The flowers of both sexes are conform, but the staminate plants are readily distinguished from the pistillate ones by their more slender growth, the spikes overtopping the leaves; while in the pistillate plants the latter are longer than the spikes.

BUCHLOË, Nov. Gen.

Flores diœci, heteromorphi.

Planta mascula: spiculæ 2-3-floræ, in spicis unilateralibus distichæ. Glumæ duæ uninerviæ; inferior multo minor. Paleæ duæ, æquilongæ, glumas excedentes; inferior trinervis, mucronata; superior binervis mutica. Squamulæ binæ, truncatæ, emarginatæ. Stamina tria; antheræ lineares. Ovarii rudimentum nullum.

Planta fœminea: spiculæ unifloræ in spicas 1-3 breves capituliformes obliquas vaginis foliorum superiorum involucratas congestæ; flosculo summo tabescente squamam involuciformem trifidam simulante. Glumæ duæ; spiculæ infimæ gluma inferior 1-3-nervis, apice herbaceo lanceolato-subulata seu 2-3-fida, latere inferiore glumæ superioris dorso adnata; glumæ reliquarum spicularum inferiores (quoad capitulum internæ) liberæ, multo minores, membranaceæ, ovato-lanceolatæ, acutæ, uninerves; glumæ superiores (externæ) basi cum rhachi incrassata connatæ involucrum simulantes demum lignosum, quassi osseum, ovatæ, enerviæ, pallidæ, apice herbaceo nervoso trifidæ. Palea inferior (quoad capitulum interna) brevior trinervis, herbaceo-tricuspidata; palea superior brevior binervis. Squamulæ ut in floribus masculis. Staminorum rudimenta 3 minuta. Ovarium lenticulare, brevissime stipitatum glabrum; stigmata stylis 2 erectis terminalibus multo longiora, pilis simplicibus plumosa, ex apice floris exserta. Caryopsis libera, in capitulo osseo, demum toto deciduo inclusa, sublenticularis, extus (versus paleam inferiorem), ubi embryo, plana, intus convexa.

Gramen planitierum Americæ Septentrionalis aridarum Missouriensium, Texensium, Mexicanarumque gregarium, perenne, stoloniferum, humile, sparse pilosum vel glabriusculum; ligulis barbatis.—*Buchloë*, pro nimis longo *Bubalochloë* nomen vernaculum "Buffalograss," græce reddit.

Buchloë dactyloides.

Syn. plantæ masculæ: *Sesleria dactyloides*, Nuttall, Gen. I. p. 64. *Sesleria* (?) *dactyloides*, Torrey, in Emory's Rep. 1848, p. 153, Pl. X.; id. in Whipple's Rep. Pacif. R.R. Expl., IV., p. 157. *Calanthera dactyloides*, Kunth (?) in Hooker's account of Geyer's Rocky Mountain plants, in Kew Journ. Bot., VIII., p. 18. *Triodiæ spec.*, Bentham, in Pl. Hartweg, nro. 250, p. 28. *Lasiostega humilis*, Rupprecht (ined) in Benth. Pl. Hartw. Corrig., p. 347.—Drummond Tex., III., nro. 378. Lindheimer, Pl. Tex. exsicc. 569. Fendler N. Mex., 940. Berlandier, nro. 1612 and 1614. Hartw. 250 (fide Gray).

Syn. plantæ fœmineæ: *Antephora axilliflora*, Steudel, Glum. I., p. 111—Drummond Tex., II., 359. Wright, 1849, 785; 1851–52, 2079 (fide Torrey).

This remarkable plant is found in our western prairies from the British possessions throughout the Missouri Territory, Nebraska, Kansas, and New Mexico, down to Texas and Northern Mexico, and is, under the name of "*Buffalo-grass*," well known to hunters and trappers as one of the most nutricious grasses, on which, for a part of the year, subsist and fatten the immense herds of buffalo and the cattle of the hunter and the emigrant. Since the time of Nuttall, who published an account of it, in his "Genera," as early as 1818, the male plant has been collected by almost every botanist traversing those regions. The female plant had escaped the observers until it was described by Steudel, in the year 1855, from Drummond's Texan specimens, as a totally different plant and belonging even to a different tribe. Though Prof. Torrey had already, in Emory's Report, 1848, suggested the probability of the Buffalo-grass being a diœcious plant, the possibility that Nuttall's *Sesleria dactyloides* and Steudel's *Antephora axilliflora* could be the male and the female of the same species was not even suspected, till finding both together in a collection sent by my brother, Henry Engelmann, who, as geologist, accompanied the topographical corps attached to the army of Utah, I was struck with their similarity. My surmise, much doubted at first, became a certainty, when I discovered among some male plants, collected by A. Fendler, about Fort Kearny on the Platte River, a monœcious specimen, showing both male and female flowers on different stalks from the same rhizoma. A figure of this important specimen is given on Pl. XII., fig. 3.

That our plant is distinct from *Sesleria* has already been stated by Torrey (l. c. p. 154), and indeed by Nuttall himself (l. c. p. 65), and both have pointed to its affinity to *Atheropogon* or *Chondrosium*. The description now given fully confirms both positions. It also leaves no doubt that it is not an *Antephora*, nor at all paniceous. A new generic name, therefore, had to be given, and I have preferred to propose an abbreviated translation of the popular and widely known name of "Buffalo-grass," retaining of course Nuttall's original specific appellation. The synonyms of the male plant, supplied through the kindness of Prof. Gray, are uncertain, Kunth never having published such a name as *Calanthera*, which, moreover, is quite unmeaning; nor can I learn that a genus *Lasiostega* has ever been described.

The Buffalo-grass grows in dense tufts, sending out stolons. These, in most herbarium specimens, are only a few inches long, with internodes of ½—2 inches in length; Lindheimer, however, sends specimens from New Braunfels, Texas, with stolons 1—2 feet long, the internodes often measuring over 3 and even as much as 5 inches. The male plant seems to throw out more numerous runners than the female, and may often overspread and kill it out, which would account for the much greater scarcity of the latter.

Leaves 2—4 inches long, ½—1½ lines wide, sparsely hairy or ciliate or glabrous; sheaths striate, glabrous, strongly bearded at the throat.

The flowering stems of the male plant are 4—6 or rarely 8 inches high, mostly glabrous or very sparsely hairy, generally longer than the leaves, and bear 2 or 3 alternate oblique one-sided spikes. These spikes are 3—6 lines long, and bear on the lower, outer, side of the flattened, dentate, pubescent rhachis 6—15 minutely puberulent spikelets, alternate in two rows; the uppermost spikelet is usually abortive, and is represented by a bristle. The spikelets are 2 or rarely 3 lines long, with 2 or sometimes 3 subterete flowers; they are, as usual, among chlorideous grasses, somewhat obliquely distorted; the glumes are broader on their lower side, but turning upwards, towards the upper end of the spike, they cover the upper edge of the flowers, leaving the lower edge free. The smaller lower glume is, as in this whole tribe of grasses, inside of the spike, and the larger upper one outside and much more conspicuous.

Lower glume ovate-lanceolate, with a scarious margin, convex, scarcely carinate, one-nerved, obtuse or acutish or mucronate, one-third or one-fourth the length of the flower; on the uppermost spikelet of each spike, it is much larger, and almost equal to the upper glume.

Upper glume twice as long as the lower one, much wider ovate, obtusish, with a strong middle nerve which sometimes runs out into a point or a short awn between two membranaceous teeth; in a specimen from Fort Kearny, I find on the lower side a second nerve running out into a lateral tooth; a third nerve on the upper side is very indistinct; other spikelets of the same specimen show the ordinary structure.

Lower palea convex, obtusish, 3-nerved, middle nerve in the lower flower running out into a mucro, in the upper one mostly even with the membranaceous margin.

Upper palea as long as, or a little exceeding, the lower one, which partly envelopes it, 2-nerved, 2-carinate, obtuse and scarious at tip.

Scales, *lodiculæ*, 2 at the margin and inside of the lower palea, minute, triangular-truncate, undulate or emarginate.

Stamens 3, scarcely exceeding the paleæ; anthers linear, bifid at both ends, 1 line long; filaments much shorter. Pollen grains of the dry anther, immersed in water, globular, smoothish, 0.017 line in diameter.

The stalk of the female plant is much shorter than the leaves, usually 1½—2 and very rarely 3—4 inches high; it is leafy to the top, the broad, ventricose, many-nerved sheaths of the 2 or 3 uppermost leaves serving as involucres for the flower-heads. These heads, 3—3½ lines long, are usually 2 in number, one almost sessile between both top leaves and on the side of the lower one, the other on a flattened pedicel on the side of the upper leaf; sometimes a third head is noticed still higher, and on the side of the lowest one. The pedicels of these heads are nothing but the common peduncle or rhachis terminating the stem, and the heads themselves correspond to as many lateral spikes of the male plant, in position as well as in structure; they are only more contracted, consist of fewer, one-flowered, spikelets, and turn obliquely upwards, while the male spikes turn obliquely downwards. Where the number of spikelets does not exceed 3, the head is ventricose-cylindric, or, in fruit, subglobose; but when the number is larger, it is compressed and laterally elongated, showing distinctly enough the biserial arrangement. The pistillate spikelets are like the staminate ones arranged so that the lower glume is inside and the upper one outside in the head.

The thick rhachis of these heads is firmly united with the upper glumes, which in fruit become ligneous; they have a pale whitish or straw color, and smooth and shining surface, with a few scattered hairs; at maturity they separate entire from the common peduncle, at the insertion of which a tuft of short hair is noticed.

The lower glume is a small triangular or ovate, obtuse, acute or acuminate, 1-nerved, carinate scale, completely hidden in the interior of the head. The lower glume of the lowest spikelet only is larger with 2 or 3 foliaceous points, turned half outside and with its lower edge united to the back of the corresponding upper glume.

Upper glumes much larger, the largest organ of the spikelets, convex outside, concave inside, broadly ovate, narrowed at base, and separated there from one another by a deep and rounded sinus; terminating into 3 herbaceous, nerved, lanceolate-linear lobes, a larger central and 2 smaller lateral ones.

Lower palea, of course, opposite the upper glume and therefore turned towards the centre of the head, much smaller, also 3-pointed, with two further lateral membranaceous teeth, enveloping the upper palea.

Upper palea still smaller, 2-nerved, membranaceously 2-pointed.

Scales similar to those of the staminate flowers.

Three minute rudimentary stamens at the base of the short-stipitate, compressed, lenticular ovary, which at the apex bears 2 rather short erect styles and elongated stigmata, protruding from the apex of the flower. Hair of the stigma simple, rather short and scarcely dentate.

Mature head ventricose, thick, extremely hard, enclosing the loose grain. Grain about 1 line long, orbicular, ovate, flat on the outer (turned towards the lower palea and inside of the head) and convex on the inner face, 2-pointed at the apex by the persistent bases of the styles. Embryo on the flat outer side of the grain and almost as long as it.

Each spike or head has, with very rare exceptions, at the upper end an incomplete rudimentary spikelet, consisting of a single 2—3-pointed upper glume. This, with the similar looking lower glume of the lowest spikelet, seems at first glance to form an involucrum for the head; or the upper glumes together have been taken for an involucrum; the lower glumes were overlooked, and the plant placed with the paniceous genus *Anthephora*, Schreb., which is closely allied to *Cenchrus*. From the analysis given above, it will be seen that this view is based on a very superficial examination of our plant; and that the structure of the head is entirely analagous to that of the staminate spike of this and the spike of the chlorideous grasses in general, from which the Buffalo-grass can in no manner be separated.

MONANTHOCHLOË, Nov. Gen.

Flores diœci, subconformes.

Spiculæ singulæ, terminales, sessiles, 3—5-floræ, glumis destitutæ.

Planta mascula: flos infimus neuter, e palea inferiore foliacea, sola aut cum palea superiore hyalina integra, emarginata vel bipartita consistens. Flos secundus rarissime unipaleaceus, interdum neuter, plerumque æque ac tertius nec non quartus teres, elongatus, staminiferus. Flos ultimus plerumque abortivus ad stipitem bipaleaceum reductus. Palea floris staminiferi inferior ovato-lanceolata, convoluta, apice scarioso obtusa, sursum virescens, indistincte multi(9—11)-nervis, infra pallida, coriacea, enervis. Palea superior inferiorem paulo excedens, convoluta, apice scarioso obtusa, dorso bicarinata. Squamulæ nullæ. Stamina 3; antheræ lineares utrumque profunde bilobæ, filamentis longiores, vix exsertæ. Ovarii rudimentum nullum.

Planta fœminea: spiculæ masculis simillimæ, flores plerumque 2, rarius 1 aut 3 fertiles. Palea inferior flores superiores basi involvens. Palea superior bialato-carinata, alis circum flores superiores convolutis. Squamulæ nullæ. Stamina 3 rudimentaria minuta. Ovarium lanceolato-lineare, trigonum, basi in stipitem angustatum, apice acutato bifidum glabrum; styli terminales erecti, ovarium æquantes; stigmata stylis duplo longiora, ex floris apice exserta, pilis simplicibus plumosa. Caryopsis libera triangularis.

Gramen littoribus sinus Mexicani Texanis Floridanisque incolum, ramosum, stoloniferum, fruticulosum; foliis brevissimis, rigidis, squarrosis; floribus vix conspicuis.—*Monanthochloë* græce gramen floribus (spiculisve) singulis gaudens.

MONANTHOCHLOË LITTORALIS, nov. spec.

Perennis suffruticosa ramosissima stolonifera glabriuscula; foliis fasciculatis linearibus falcatis brevibus rigidis multinerviis, apice obtusiusculo cartilagineis, supra ad nervos puberulis, margine ciliato-scabris; ligulis abbreviatis truncatis breviter ciliatis; spiculis singulis in apice caulis ramulorumque intra folia superiora sessilibus.

This peculiar and most interesting grass has been sent by *Drummond* from Texas, by *Berlandier* (No. 3227) from the region of Matamoras (mouth of the Rio Grande?) by *Blodgett* from Key West, Florida, and *Lindheimer* found it in flower, in May, on the island of Galveston, Texas, "covering large tracts of moist, sandy, saline soil." I have been able to examine Berlandier's specimens, female plants in flower, and those of Lindheimer, who collected both sexes, the females more abundantly than the males. The ripe fruit is unknown to me.

Stems 5—8 inches high, much branched, erect or often at last decumbent and rooting; upper branches mostly short, 4—6 lines long.

Leaves short, rarely more than 3 lines long, very rigid, strongly nerved, apparently permanent in winter, mostly crowded at the ends of the stems and branches. The upper leaves all bear axillary buds more or less developed. Spikelets (between 3 and 4 lines long) solitary, terminal, enclosed by the uppermost leaves, which form a complete and uninterrupted transition to the floral envelopes, the uppermost leaf, without the intercession of glumes, representing the lowest palea of the spikelet. This uppermost leaf or lowest palea has a doubtful and intermediate character, and might be taken for one or the other, or for a glume, whenever it is empty; but often it includes an hyaline scale, which can not be any thing else but an upper palea, and therefore characterizes this lowest organ of the spikelet as the lower palea of the lowest always incomplete and neutral flower. It can not be supposed that a glume is missing or abortive, as we can follow the regular succession of bud-bearing leaves to this lowest floral leaf or palea. The upper palea of this lowest flower, when present, is usually extremely thin and transparent; it is small or large, flat or reflexed, nerveless or (very rarely, like the other upper paleæ) bicarinate*; it is entire, lanceolate, or ovate, or emarginate, or bilobed, or sometimes divided into two unequal lanceolate parts, placed side by side, and in some flowers (see Pl. XIII., fig. 6), laterally protruding from the base of the lower palea and rather oddly placed on both sides of the spikelet.

The second flower is like all the others pedicelled, and is mostly perfect, that is, staminate or pistillate; in a very few instances (see Pl. XIII., fig. 5, and Pl. XIV., fig. 20) it was found neutral and either with a somewhat foliaceous lower palea, or with both paleæ smaller than in the other flowers; rarely it is reduced to a single palea, which is herbaceous or membranaceous; in a single instance it was almost entirely suppressed, and the third flower, above and on the same side as the lowest one, appeared to be the second. The rare case where two single empty paleæ alone are left of the two lowest flowers approaches nearest to the regular structure of grass flowers; these paleæ then assume the place and apparent function of glumes, and the spikelet then resembles that of *Kœleria*, for example, in the arrangement of its parts. The normal variability in the formation of the floral envelopes of this grass thus furnishes an interesting clue to the morphology of these organs.

The third flower, usually well developed, is sometimes (oftener in the female than in the male plant) reduced to a mere rudiment.

In female plants I have never seen more than 2 pistillate flowers, and very rarely a rudimentary fourth flower; male plants show often 3 staminiferous flowers, usually with an upper abortive one.

The spikelet therefore is destitute of glumes and consists of 3—5 flowers, of which always the lowest, sometimes the second and usually the uppermost one, are neutral or rudimentary, and of which 1—3 of the middle ones bear stamens or pistils.

The lower palea of the fully developed flowers is ovate-lanceolate, obtuse at the scarious point, and envelopes not only the upper palea but also the base of the upper flowers; it is faintly 9—11-nerved in the upper and indistinctly 3-nerved in the lower half, thus representing, as it would seem, both parts of the leaf, the sheath and the blade; nothing like a ligula, however, can be found.

* In this case the lower palea also is less leaf-like, and has only a short foliaceous cusp.

The upper palea is narrower and a little longer than the lower one, especially in the male flowers, obtuse and scarious at tip, and in the female closely envelopes the pistils. In the staminate flower it is bicarinate on the back; in the pistillate flower these keels are developed into wings, which are rolled around the upper flowers, as is indicated in the diagrams.

No scales (*lodiculæ*) were seen in either flowers.

Stamens scarcely longer than the paleæ; anthers linear, deeply bilobed at both ends, longer than the filaments. In the pistillate flower 3 minute triangular bodies seem to represent the stamens.

The stipitate ovary is elongated, triangular, with one angle towards the lower, and two towards the keels of the upper palea; it is deeply bifid, the lobes terminating into straight erect styles. Simple hairs of the feathery stigma scarcely dentate.

The systematic position of this grass is certainly a doubtful one, and the opinion which I venture to offer, that its next allies must be looked for among the *Chlorideæ*, a tribe principally distinguished by its one-sided compound spikes, may appear paradoxical. I take it to be the most reduced form of this tribe, where a single and incomplete spikelet only is left of the one-sided spikes. Thus *Monanthochloë* would find its place near the similarly creeping *Cynodon*, and with those other seaside-grasses, the *Spartinæ*.

Happily, to confirm my position, I find in Torrey's lately established genus *Munroa* (Whipple's Botany in Pacif. R.R. Rep., IV., 158), the old *Crypsis squarrosa*, Nutt., an intermediate not quite so much reduced form of a grass. *Munroa* is evidently nearly allied to *Monanthochloë*, but has, instead of one, three spikelets, included between the uppermost leaves, on a *terminal* rhachis; two lateral oblique and one-sided, and the terminal one, straight. Prof. Torrey has already noticed the oblique position of the glumes of the lateral spikelets, which, together with the one-sided position on the rhachis, is characteristic of *Chlorideæ*. The terminal spikelet is more regularly formed, as is also the terminal spikelet in the staminate spikes of *Buchloë*, (see Pl. XIII., fig. 8.) This terminal spikelet, which, from its position, can not be oblique, is, in *Monanthochloë*, all that is left.

The elongated, feathery stigmata, protruding from the apex of the flower, are found in all three of the genera mentioned, as also in *Spartina* and other chlorideous grasses, though not in all of them.

The principal difference of *Monanthochloë* and *Munroa* from *Chlorideæ* proper, consists in their spikelets being terminal or arranged on a terminal rhachis, and not on lateral more or less digitate spikes. If this difference should be deemed too important to let them stand in this alliance, they must be classed with *Sesleriea*, a tribe already distinguished by Koch in his German Flora, but since overlooked by the latest writers on grasses, though so well characterized and distinguished from *Festuceæ* by the flowers being arranged in terminal, sometimes one-sided, spikes, and by the elongated stigmata protruding from the apex of the flowers.

EXPLANATION OF PLATES.

Buchloë dactyloides.

Plate XII. Fig. 1.—A female plant with stolons, in fruit.
Fig. 2.—A larger and a smaller stalk with male spikes.
Fig. 3.—A specimen bearing both male and female flowers. These figures are of natural size; all the others are more or less magnified.

Analysis of the male flower.

Fig. 4.—An unusually short staminate spike in the position of the pistillate spike at Pl. XIV., Fig. 3, and with scarcely more spikelets, to show the analogy of both.
Fig. 5.—Diagram of the same.
Fig. 6.—A two-flowered spikelet, seen from the inside of the spike, so that the lower glume is exhibited.
Fig. 7.—A tri-flowered spikelet.
Fig. 8.—Terminal spikelet of a spike, with larger lower glume.
Fig. 9.—Flower open, with the stamens.
Fig. 10, *a. b. c.*—Different forms of the lower glume.
Fig. 11, *a. b. c.*—Same of upper glume; *c.* shows an upper glume with a secondary nerve—a rare occurrence, found occasionally in specimens from Fort Kearney.
Fig. 12.—Lower palea: *a.*, of the lower flower, midrib running out into a point; *b.*, of the upper flower, blunt.
Fig. 13.—Upper palea: *a.*, from the inside and partly folded, showing also the scales; *b.*, same, unfolded, also with the scales; *c.*, same, from the upper flower, both nerves at point much closer than in the lower flower.

Analysis of the female flower.

Plate XIV., Fig. 1.—Two heads in flower, in their natural position; the involucral leaves somewhat opened.
Fig. 2.—Diagram of the lower of these heads, *a.*; the upper head, *b.*, has also 3 fertile flowers, but their arrangement is exactly reversed.
Fig. 3.—An elongated head with 5 fertile flowers, showing their arrangement in an one-sided spike; *a.*, the lower glume of the lowest spikelet; *b.*, lowest spikelet, as well as *d.* and *f.* on the off side of the rhachis; *c.* and *e.*, two spikelets alternating with these, on the near side of the rhachis; *g.* last sterile glume, the rudiment of the sixth flower.

Fig. 4.—Diagram of same; the letters correspond with t in the last figure.
Fig. 5.—Rhachis of 3 spikelets, with the base of 2 invo leaves. in the axil of the lower one a bud.
Fig. 6.—Lower and upper glume of the lowest spikelet of the upper is attached to the back of the lower g
Fig. 7.—One of the other spikelets, seen from the inside o hibiting the lower glume, part of the upper one half of the lower palea.
Fig. 8.—Different forms of the lower glume; *a.*, narrow foliaceous at the upper half—a very rare occurre
Fig. 9.—Lower palea of the flower; *a.*, from the inside, r p; *b.* outside, unfolded.
Fig. 10.—Same of the fruit; *a.* from the inside, folded around the upper palea, both dorsal nerves of whic ble; *b.*, same unfolded.
Fig. 11.—Upper palea; *a.*, from the inner side ata ding; *b.* same from the back, sho ; *c.*, palea including the ripe seed, see sca ble.
Fig. 12.—Scales; *a.* truncate, *b.* emarginate-bilobed;
Fig. 13.—Ovary with the styles, more magnified. ovary one of the 3 rudimentary stamens scales visible.
Fig. 14.—Ovary, still more magnified, with all three rudimentary stamens; scales removed.
Fig. 15.—Part of a stigmatic hair, highly magnified.
Fig. 16.—Vertical section of a fruit-bearing spikelet, exhibiting both glumes, (the outer upper one the longest and much thickened) both paleæ and the grain.
Fig. 17.—Grain; *a.* seen from the convex inner side (turned towards the upper palea); *b.* horizontal, and *c.* vertical section of same; *a.* and *b.* more magnified.

Monanthochloë littoralis.

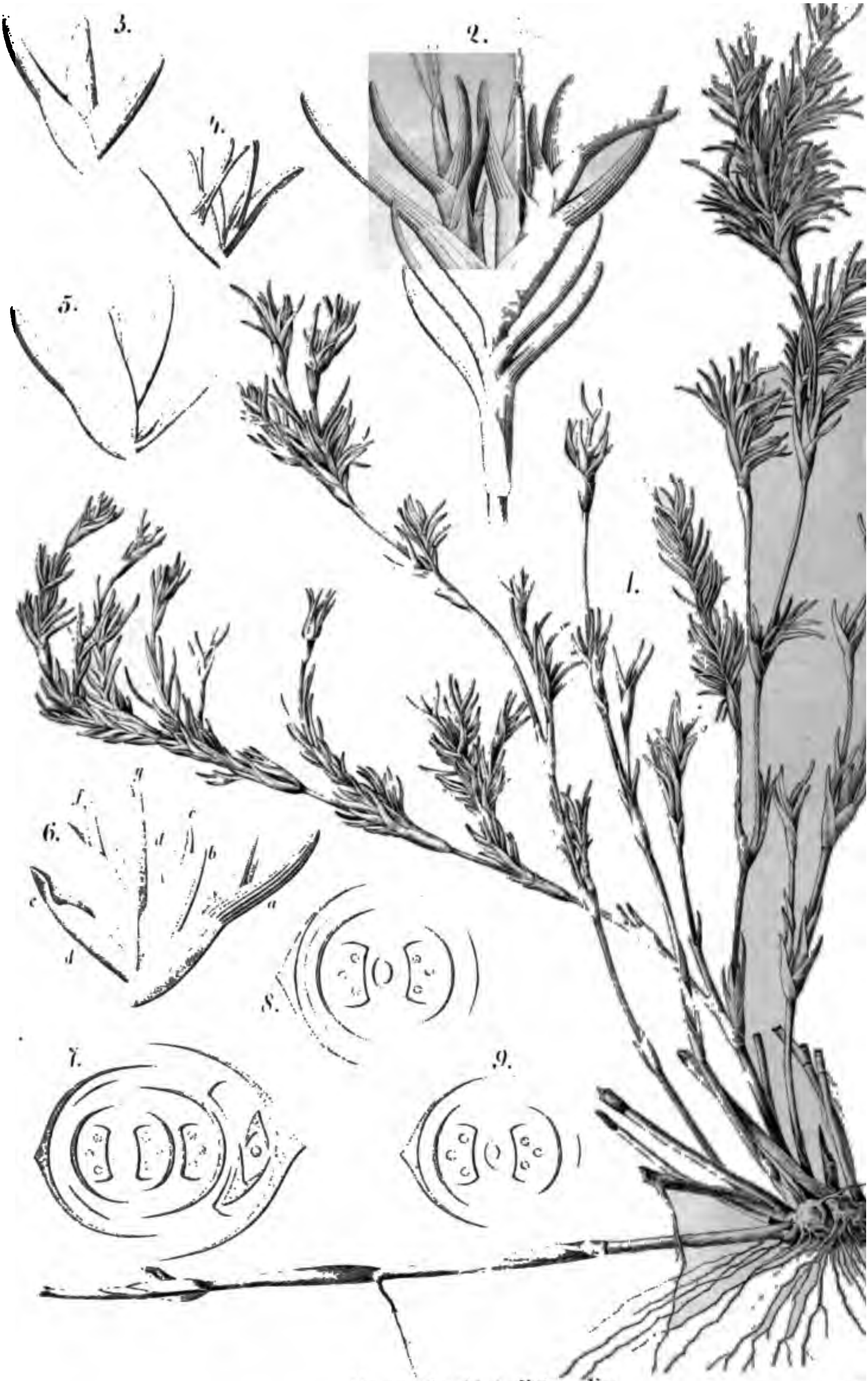
Pl. XIII., Fig. 1.—Female plant in flower; here and there the small spikelets are recognized by the protruding stigmata. Natural size; all the other figures are magnified.
Fig. 2.—Top of a stem of the same plant, showing the manner of ramification, the different leaves, the bifid scales which form the lowest leaf of each branch towards the stem, aud which correspond to the upper paleæ. The figure shows the lower stem leaves, which have no branches in their axils, with smaller, narrower sheaths, while the upper branch-bearing leaves have large ventricose sheaths.

Analysis of the male flower.

Fig. 3. —Spikelet consisting of the foliaceous lower palea, including an hyaline scale, and two flowers. The plan is the same as in the female flower, Pl. XIV., Fig. 22.
Fig. 4.—Single flower, open, showing the stamens.
Fig. 5.—Spikelet with first and second flowers neutral, and both upper ones staminate.
Fig. 6.—Top of a branch, exhibiting the uppermost leaf, *a.*, with an axillary branch, composed of the lowest bifid, *b.*, and two regularly formed leaves; the lower palea of the lowest flower, *c.*, is less

Buchloë dactyloides.

J. Roetter & G. Engelmann del.



Monanthochloë littoralis.

Third Series of Descriptions of BRYOZOA *from the Palæozoic Rocks of the Western States and Territories.*

BY H. A. PROUT, M.D.

SEMICOSCINIUM, n. g.

Bryozoum, a leaf-like expansion, somewhat penniform without a shaft; sole formed of longitudinal and horizontal parallel ridges, surmounted by a cellular tissue, divided perpendicularly by thin longitudinal septa, corresponding to the ridges and supporting parallel lines of moderately large tortuous tubes alternately approximating and receding from each other; covered by a dense stony crust, divided into a more or less regular net-work, representing irregular longitudinal rays (obliquely lateral here), and dissepiments which bound rhomboidal, or oval, fenestrules, giving passage to cells originating in the cellular tissue of the sole, and from the sides of the tortuous tubes, all of which cells come to the surface in a direction obliquely upward and outward to the plane of expansion. The tortuous tubes alternately approximate and diverge, so as to give place to quincuncial oval openings, forming a part of the fenestrules which have their origin in the cellular substance of the sole; each tortuous tube has a line of cell pores on each side, which find their way through the fenestrules to surround a central stylus of cell pores, which seem to have their origin in the cellular tissue of the sole at the bottom of the deep fenestrules.

SEMICOSCINIUM RHOMBOIDEUM, n. sp.

Bryozoum, a flat, leaf-like expansion, about one line in thickness, distinctly penniform at about two inches from its lower border, longitudinal rays (lateral) irregularly thickened or expanded, waved, or sharply flexuous, leaving the mesial line at an angle of about 65°. Dissepiments subangular, smaller than the rays, expanding obliquely downward and inward to the plane of expansion, meeting the longitudinal rays at an angle of about 65°, both crossing the longitudinal ridges, and tortuous tubes, at an acute angle. Fenestrules or meshes irregularly rhomboidal, or suboval, sometimes quincuncial, looking downward, inward, and backward, and becoming obliquely conical before terminating upon the sole; *cells* filling the fenestrules irregularly in a circle around a central frustrum, which seems to have been formed of larger cells; *sole* formed of ridges, longitudinal to what would be the shaft, more or less parallel, surmounted by a cellular tissue, longitudinal septa, and lines of tortuous tubes.

Geol. Pos. and Loc.—Devonian Shell-beds, Falls of the Ohio. In the collection of Dr. B. F. Shumard.

This interesting fossil was imbedded in a very refractory rock, and was so much weather-worn, and the fenestrules so filled with foreign matter, that it was only after very laborious investigation that we were enabled to obtain any thing approaching a definite view of its organization. The views which we have offered will, we believe, be found to be in the main correct. The great diversity of form presented in its complex organization under the influence of different degrees of weathering rendered it often difficult to determine whether we had under our observation some modification of normal development, or some alteration from atmospheric influences.

It will be seen that it resembles the *Coscinium* of Keyserling in several features of its organization; for instance, in the rythmical development of open spaces between the approximating and diverging tubes, and in the structure of the base or sole; but it differs by its want of a middle plate separating the cells on one face from those on the other, or by its having cells only on one face, and by the interfenestrular space being, in one case, formed of dense stony matter, while, in the other, it is formed entirely of small cells. One will be struck by the resemblance of the lines of middle tubes with three cells to each opening, to the figures of the *Retepora prisca*, Goldf., and the resemblance of the form of its fenestrules to the *Fenestella arthritica*, Phillips, and the *Gorgonia ripisteria*, Goldf.; whether some of these may not be founded on imperfect views of the same organization, remains to be determined. The *Retepora prisca*, of Portlock, differs somewhat from the *Retepora prisca*, Goldf., and is clearly a *Ptylopora*. Our species has no distinct shaft between the longitudinal ribs, but there is an approach to it in a mesial line, from which the rays depart, on either side, which is only gradually developed from below upward. The *Coscinopora sulcata*, Goldf., resembles our species; it is probably somewhat similar in structure, judging from the surface indications given by him in his description.

8 L. × 10 T.
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FENESTELLA HEMITRYPA, n. sp.

Bryozoum, a fan-shaped expansion originally infundibuliform, covered on the medallion face by a thin incrustation with cells invisible to the naked eye, and resembling under a lens a delicate flustra; beneath this crust the fenestrules are regular, and penetrate most generally to the rev

Longitudinal ribs, stout, straight, basaltiform but round and irregular when more perfect, witl ed of projecting tubercles separating two lin which are nearer to the tubercles than to the b nestrules; these tubercles unite at top and waved ridges in the direction of the longitudinal which the lines of cells from opposite sides of t and are cemented with the ridges into a common plate, supported by the lines of tubercles. When st this crust, the keel appears to be a beautiful chain li bercles, with a line of pores on either side, as in other of Fenestella.

Dissepiments short, thick, and deeply depresse ing to be only regular expansions of the ribs, sepa oblong oval and deeply concave fenestrules from each ot

Fenestrules oblong, oval, frequently closed at bott opening by a slight slit on the reverse surface. T longitudinally give 8 to 9, and transversely about fenestrules.

Cells large, about two to each fenestrule, looking u to the plane of expansion.

Reverse minutely granular when perfect, striate when w with several pedicles near the base.

Geol. Pos. and Loc.—Second Archimedes Limestone of the Carboniferous series, Barrett's Station, St. Louis County, Mo. In my own collection.

This beautiful species resembles somewhat the *Hemitrypa oculata* of Phillips (Pal. Fos.), but differs materially in having the cells on the inside of the Bryozoum, in the entire penetration of the fenestrules to the reverse, and in other characters not assigned to his genus. It resembles *F. Archimedes* (Hall), but is distinctly pedicled.

GENUS LIMARIA, Steininger.

Syn. *Ceramopora*, Hall.

Bryozoum small ramous, or large encrusting, sometimes in hemispheric flattened forms, or in plates superimposed; *cell-sheaths* arranged in irregular alternating lines, imbricating, apertures arching or triangular, with apex above; cells numerous, penetrating the sheath to waved or undulating long tubes, the cementation of which forms the thickened basis on which the cell-sheaths repose.

We have here associated the *Ceramopora* of Hall with the *Limaria* of Steininger, modifying the generic descrip-

questionable, whether the differences on which Rœmer established the genus *Marginaria*, or those on which Milne Edwards established the genus *Escharina*, will be found sufficiently essential to justify their separation from *Flustra*. It can not be considered otherwise than a great evil to multiply genera, where specific distinctions would amply supply all the demands of scientific classification. The variation of type by essential structural modifications should form the only true basis of generic distinctions.

Our species resembles the *F. irregularis of Lonsd.* (*Dix. Geol. of Sussex*, p. 319, Tab. xviii., B. fig. 9, 10, 11), but differs by the situation of the ovarian capsules at the base of the cells, and the absence of notches at the extremities of the straight borders of the apertures.

14—16 T.	FLUSTRA TUBERCULATA, n. sp.

Bryozoum, a single encrusting calcareous expansion, formed of oval, hexagonal, or mostly quadrangular cells, visible to the naked eye, in juxtaposition, opening directly or obliquely upward on one face of the Bryozoum, being irregularly alternate in their distribution; *cells* mostly open, by the destruction of their exterior expansion; *walls* thin, common to adjoining cells, characterized by four round tubercles at each angle of the cell when quadrangular; *exterior covering*, where traced, a flat disc with small apertures a little above the centre; occasional small openings at the junctions of the cells, which, probably, represent the former seat of the gemmiferous capsules; cells 14 to 16 in a space of two lines.

Geol. Pos. and Loc.—Second Archimedes Limestone of the Carboniferous series, Barret's Station, St. Louis County.

We are compelled in offering these two species of Flustra, to give a passing notice to a remark made by M. Pictet in his "*Traité de Paléontologie*," in which he asserts that the great majority of Palæozoic species of *Cellulina* (*Escharoides*, Milne Edw.), which have been described by authors, do not really belong to this order, but to the *Centrifugina* or Bryozoa with long tubes. It will be obvious, we believe, from the figures and descriptions given above, that some families at least of the *Cellulina* have lived during the Palæozoic period; the cells of the two species above are such as we find in modern *Celleporina*, and such as no one would be inclined to refer to the *Tubuliporina*. We are inclined to believe that many other proofs could be furnished of the inaccuracy of the opinion to which we have referred.

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L. T.
$8\frac{1}{3} \times 5$

POLYPORA TUBERCULATA, n. sp.

Bryozoum **a fan-like expansion, probably one or two inches wide.**

Longitudinal rays **moderately large, pretty uniform in size, suddenly enlarged before and after bifurcation; dichotomizing at one, one and a half, and near two lines apart; dichotomizing oppositely on two branches from the main branch; stems scarcely diminished one-half by branching and rapidly attaining their original size.**

Dissepiments **small, about one-third as large as the rays, about one-third the transverse diameter and one-fifth the longitudinal diameter of the fenestrules, slightly depressed, not expanding much at junction with the rays.**

Fenestrules **oblong subquadrangular, sometimes shortly spatulate or irregular near the bifurcations, twice as long as broad, slightly broader than the rays generally opposite. In a space of two lines longitudinally there are three and four-fifths, and transversely five fenestrules; or, in five millimetres, there are four longitudinally, and six transversely.**

Cell-pores **small, round, with thin lips slightly raised above the surface, alternate, their own diameter apart, in from three to six more or less regular lines upon each ray,** having a very slightly raised keel between them, and having generally on the middle keel an irregular line of round tubercles, which sometimes intermits, and sometimes shows a disposition to become double. Cell-pores five, tubercles three or four to each fenestrule.

Reverse covered by a dense cortical substance, with a few scattered granules.

Geol. Pos. & Loc.—Third or Upper Archimedes Limestone of the Carboniferous series, Chester, Ill. In my own collection.

Comparisons.—This delicate species bears some analogy in its measurements and general features to the *P. bifurcata* (Fischer, Oryct. Mos.) as quoted by Keyserling, which was described by the latter from a specimen ground upon the reverse. Independently of the lines of tubercles upon the longitudinal rays, there are other minor differences, which will show that they are not identical,—such as the slow development of the longitudinal ribs, the greater number of cell-pores upon them, and probably the more oval form of the fenestrules in our species. The *Polypora fastuosa*, D'Orb., *Gorgonia*, Kon., and *Retepora laxa*, Phill., are too imperfectly described to be submitted to comparison from descriptions

alone. Where the general characters are so nearly alike as in the genus *Polypora*, it is often difficult to establish specific differences among them; in many cases this can be attained only by accurate measurement and minuteness of detail in our specific descriptions. The *P. incepta* of Hall is a carinated species, but it has no line of tubercles on the longitudinal rays.

L. T.
3×4

POLYPORA BIARMICA, Keyserling.

This species is found in the Upper Archimedes Limestone of Chester, Illinois; at least, there are such slight differences between the specimens observed and that described in the excellent description given by him of this species, that we could find no grounds on which to base a separation. The measurements given are precisely the same, and the only differences are, in the existence of four cells after bifurcation, and as high as eight after full expansion of the rays. These data are surely not sufficient to authorize a specific distinction. It has four pores to each fenestrule. The *P. biarmica* is a Permian species, but is here found below the Coal Measures of the Carboniferous series of the Western States.*

L. T.
$3\frac{1}{2}$×7.

FENESTELLA BANYANA, n. sp.

Bryozoum funnel-shaped, widely expanded, fixed by many strong pedicles, some of which are single and others branched.

Longitudinal rays slender, basaltiform, with a sharp keel when much worn; but thicker, rounder, and with a line of long tubercles very slightly elevated above the surface in its more perfect condition.

Dissepiments moderately thick, expanded at junction with the longitudinal rays, slightly depressed, or on a level with the rays; one-fourth as wide as the length of the fenestrules and about half the size of the longitudinal ribs, half a line apart.

Fenestrules more or less oval near base, oblong oval near the middle of the expansion, slightly wider than longitudinal

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* In quoting Keyserling's species of *Polypora obicribrata*, (Vol. I., p. 237, Trans. Acad. of Sci., St. Louis,) it was printed "*obieribrati*" by an oversight; and in describing *P. Varsoviensis*, the words "two to three pores to each fenestrule" were accidentally omitted.

rays; in a space of two lines longitudinally, there are three and a half fenestrules, and six to seven transversely.

Cell-pores large, round, or oval, and round-lipped; when perfect, generally five to each fenestrule, except near the base, where the fenestrules are shortened by age.

Reverse minutely granular, or striate when worn, base having many single and some branching pedicles, stayed by lateral bars, which supported it when tossed by the tumultuous sea, in which it resided; its pedicles shoot downward like the rootlets of the Banyan-tree of India.

Geol. Pos. & Loc.—Second or Middle Archimedes Limestone of the Carboniferous series, Barrett's Station, St. Louis Co., Mo. In my own cabinet.

Comparisons.—The only species to which this bears a close resemblance is the *F. patula* of McCoy; but it has not a prominent keel when perfect, is much wider in its expansion, and its fenestrules are only a shade wider than the longitudinal rays; near the base it has only four large cells to each fenestrule, but more towards the border it has at least five. It may be identical, as its general outline and its measurements agree very nearly with his species. It seems, however, to be a distinct and much larger species, having a number of radicles that would indicate an expansion of at least two or three inches.

EXPLANATION OF PLATES.

PLATE XV.

Fig. 1.—Fenestralia St. Ludovici.
" 1 *a*.—The same much magnified (ideal).
" 2.—Fenestella plumosa.
" 2 *a*.—Same magnified.
" 3.—Polypora Varsoviensis.
" 3 *a, b*.—Same magnified.
" 4.—Coscinium Keyserlingi.
" 4 *a*.—Dimple magnified to show the arrangement of cells in the bottom.
" 5. Polypora intermedia.
" 5 *a*.—Same magnified.

PLATE XVI.

Fig. 1.—Coscinium cribriformis.
" 2.—Polypora Mexicana.
" 2 *a*.—Same, magnified cells (ideal).

the shaft, more or less parallel, surmounted by a cellular tissue, longitudinal septa, and lines of tortuous tubes.

Geol. Pos. and Loc.—Devonian Shell-beds, Falls of the Ohio. In the collection of Dr. B. F. Shumard.

This interesting fossil was imbedded in a very refractory rock, and was so much weather-worn, and the fenestrules so filled with foreign matter, that it was only after very laborious investigation that we were enabled to obtain any thing approaching a definite view of its organization. The views which we have offered will, we believe, be found to be in the main correct. The great diversity of form presented in its complex organization under the influence of different degrees of weathering rendered it often difficult to determine whether we had under our observation some modification of normal development, or some alteration from atmospheric influences.

It will be seen that it resembles the *Coscinium* of Keyserling in several features of its organization; for instance, in the rythmical development of open spaces between the approximating and diverging tubes, and in the structure of the base or sole; but it differs by its want of a middle plate separating the cells on one face from those on the other, or by its having cells only on one face, and by the interfenestrular space being, in one case, formed of dense stony matter, while, in the other, it is formed entirely of small cells. One will be struck by the resemblance of the lines of middle tubes with three cells to each opening, to the figures of the *Retepora prisca*, Goldf., and the resemblance of the form of its fenestrules to the *Fenestella arthritica*, Phillips, and the *Gorgonia ripisteria*, Goldf.; whether some of these may not be founded on imperfect views of the same organization, remains to be determined. The *Retepora prisca*, of Portlock, differs somewhat from the *Retepora prisca*, Goldf., and is clearly a *Ptylopora*. Our species has no distinct shaft between the longitudinal ribs, but there is an approach to it in a mesial line, from which the rays depart, on either side, which is only gradually developed from below upward. The *Coscinopora sulcata*, Goldf., resembles our species; it is probably somewhat similar in structure, judging from the surface indications given by him in his description.

8 L. × 10 T.
80

FENESTELLA HEMITRYPA, n. sp.

Bryozoum, a fan-shaped expansion originally infundibuliform, covered on the medallion face by a thin incrustation with cells invisible to the naked eye, and resembling under a lens a delicate flustra; beneath this crust the fe rules are regular, and penetrate most generally to the rev

Longitudinal ribs, stout, straight, basaltiform but round and irregular when more perfect, witl ed of projecting tubercles separating two lin which are nearer to the tubercles than to the b nestrules; these tubercles unite at top and waved ridges in the direction of the longitudinal which the lines of cells from opposite sides of t and are cemented with the ridges into a commo plate, supported by the lines of tubercles. Wher this crust, the keel appears to be a be bercles, with a line of pores on either as in of Fenestella.

Dissepiments short, thick, and deeply depresse ing to be only regular expansions of the ri pa oblong oval and deeply concave fenestrules n each ou

Fenestrules oblong, oval, frequently it opening by a slight slit on the reverse longitudinally give 8 to 9, and transver fenestrules.

Cells large, about two to each fenestrule, lookin to the plane of expansion.

Reverse minutely granular when perfect, striate when with several pedicles near the base.

Geol. Pos. and Loc.—Second Archimedes Limestone of the Carboniferous series, Barrett's Station, St. Louis County, Mo. In my own collection.

This beautiful species resembles somewhat the *Hemitrypa oculata* of Phillips (Pal. Fos.), but differs materially in having the cells on the inside of the Bryozoum, in the entire penetration of the fenestrules to the reverse, and in other characters not assigned to his genus. It resembles *F. Archimedes* (Hall), but is distinctly pedicled.

GENUS LIMARIA, Steininger.

Syn. *Ceramopora*, Hall.

Bryozoum small ramous, or large encrusting, sometimes in hemispheric flattened forms, or in plates superimposed; *cell-sheaths* arranged in irregular alternating lines, imbricating, apertures arching or triangular, with apex above; cells numerous, penetrating the sheath to waved or undulating long tubes, the cementation of which forms the thickened basis on which the cell-sheaths repose.

We have here associated the *Ceramopora* of Hall with the *Limaria* of Steininger, modifying the generic descrip-

questionable, whether the differences on which Rœmer established the genus *Marginaria*, or those on which Milne Edwards established the genus *Escharina*, will be found sufficiently essential to justify their separation from *Flustra*. It can not be considered otherwise than a great evil to multiply genera, where specific distinctions would amply supply all the demands of scientific classification. The variation of type by essential structural modifications should form the only true basis of generic distinctions.

Our species resembles the *F. irregularis of Lonsd.* (*Dix. Geol. of Sussex*, p. 319, Tab. xviii., B. fig. 9, 10, 11), but differs by the situation of the ovarian capsules at the base of the cells, and the absence of notches at the extremities of the straight borders of the apertures.

14—16 T.	FLUSTRA TUBERCULATA, n. sp.

Bryozoum, a single encrusting calcareous expansion, formed of oval, hexagonal, or mostly quadrangular cells, visible to the naked eye, in juxtaposition, opening directly or obliquely upward on one face of the Bryozoum, being irregularly alternate in their distribution; *cells* mostly open, by the destruction of their exterior expansion; *walls* thin, common to adjoining cells, characterized by four round tubercles at each angle of the cell when quadrangular; *exterior covering*, where traced, a flat disc with small apertures a little above the centre; occasional small openings at the junctions of the cells, which, probably, represent the former seat of the gemmiferous capsules; cells 14 to 16 in a space of two lines.

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L. T. $3\frac{1}{5}\times5$

POLYPORA TUBERCULATA, n. sp.

Bryozoum a fan-like expansion, probably one or two inches wide.

Longitudinal rays moderately large, pretty uniform in size, suddenly enlarged before and after bifurcation; dichotomizing at one, one and a half, and near two lines apart; dichotomizing oppositely on two branches from the main branch; stems scarcely diminished one-half by branching and rapidly attaining their original size.

Dissepiments small, about one-third as large as the rays, about one-third the transverse diameter and one-fifth the longitudinal diameter of the fenestrules, slightly depressed, not expanding much at junction with the rays.

Fenestrules oblong subquadrangular, sometimes shortly spatulate or irregular near the bifurcations, twice as long as broad, slightly broader than the rays generally opposite. In a space of two lines longitudinally there are three and four-fifths, and transversely five fenestrules; or, in five millimetres, there are four longitudinally, and six transversely.

Cell-pores small, round, with thin lips slightly raised above the surface, alternate, their own diameter apart, in from three to six more or less regular lines upon each ray, having a very slightly raised keel between them, and having generally on the middle keel an irregular line of round tubercles, which sometimes intermits, and sometimes shows a disposition to become double. Cell-pores five, tubercles three or four to each fenestrule.

Reverse covered by a dense cortical substance, with a few scattered granules.

Geol. Pos. & Loc.—Third or Upper Archimedes Limestone of the Carboniferous series, Chester, Ill. In my own collection.

Comparisons.—This delicate species bears some analogy in its measurements and general features to the *P. bifurcata* (Fischer, Oryct. Mos.) as quoted by Keyserling, which was described by the latter from a specimen ground upon the reverse. Independently of the lines of tubercles upon the longitudinal rays, there are other minor differences, which will show that they are not identical,—such as the slow development of the longitudinal ribs, the greater number of cell-pores upon them, and probably the more oval form of the fenestrules in our species. The *Polypora fastuosa*, D'Orb., *Gorgonia*, Kon., and *Retepora laxa*, Phill., are too imperfectly described to be submitted to comparison from descriptions

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L. T.
3½×7.

FENESTELLA BANYANA, n. sp.

Bryozoum funnel-shaped, widely expanded, fixed by many strong pedicles, some of which are single and others branched.

Longitudinal rays slender, basaltiform, with a sharp keel when much worn; but thicker, rounder, and with a line of long tubercles very slightly elevated above the surface in its more perfect condition.

Dissepiments moderately thick, expanded at junction with the longitudinal rays, slightly depressed, or on a level with the rays; one-fourth as wide as the length of the fenestrules and about half the size of the longitudinal ribs, half a line apart.

Fenestrules more or less oval near base, oblong oval near the middle of the expansion, slightly wider than longitudinal

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Cell-pores large, round, or oval, and round-lipped; when perfect, generally five to each fenestrule, except near the base, where the fenestrules are shortened by age.

Reverse minutely granular, or striate when worn, base having many single and some branching pedicles, stayed by lateral bars, which supported it when tossed by the tumultuous sea, in which it resided; its pedicles shoot downward like the rootlets of the Banyan-tree of India.

Geol. Pos. & Loc.—Second or Middle Archimedes Limestone of the Carboniferous series, Barrett's Station, St. Louis Co., Mo. In my own cabinet.

Comparisons.—The only species to which this bears a close resemblance is the *F. patula* of McCoy; but it has not a prominent keel when perfect, is much wider in its expansion, and its fenestrules are only a shade wider than the longitudinal rays; near the base it has only four large cells to each fenestrule, but more towards the border it has at least five. It may be identical, as its general outline and its measurements agree very nearly with his species. It seems, however, to be a distinct and much larger species, having a number of radicles that would indicate an expansion of at least two or three inches.

EXPLANATION OF PLATES.

PLATE XV.

Fig. 1.—Fenestralia St. Ludovici.
" 1 *a*.—The same much magnified (ideal).
" 2.—Fenestella plumosa.
" 2 *a*.—Same magnified.
" 3.—Polypora Varsoviensis.
" 3 *a*, *b*.—Same magnified.
" 4.—Coscinium Keyserlingi.
" 4 *a*.—Dimple magnified to show the arrangement of cells in the bottom.
" 5. Polypora intermedia.
" 5 *a*.—Same magnified.

PLATE XVI.

Fig. 1.—Coscinium cribriformis.
" 2.—Polypora Mexicana.
" 2 *a*.—Same, magnified cells (ideal).

alone. Where the general characters are so nearly alike as in the genus *Polypora*, it is often difficult to establish specific differences among them; in many cases this can be attained only by accurate measurement and minuteness of detail in our specific descriptions. The *P. incepta* of Hall is a carinated species, but it has no line of tubercles on the longitudinal rays.

| L. T. 8×4 | POLYPORA BIARMICA, Keyserling.

This species is found in the Upper Archimedes Limestone of Chester, Illinois; at least, there are such slight differences between the specimens observed and that described in the excellent description given by him of this species, that we could find no grounds on which to base a separation. The measurements given are precisely the same, and the only differences are, in the existence of four cells after bifurcation, and as high as eight after full expansion of the rays. These data are surely not sufficient to authorize a specific distinction. It has four pores to each fenestrule. The *P. biarmica* is a Permian species, but is here found below the Coal Measures of the Carboniferous series of the Western States.*

| L. T. 8½×7. | FENESTELLA BANYANA, n. sp.

Bryozoum funnel-shaped, widely expanded, fixed by many strong pedicles, some of which are single and others branched.

Longitudinal rays slender, basaltiform, with a sharp keel when much worn; but thicker, rounder, and with a line of long tubercles very slightly elevated above the surface in its more perfect condition.

Dissepiments moderately thick, expanded at junction with the longitudinal rays, slightly depressed, or on a level with the rays; one-fourth as wide as the length of the fenestrules and about half the size of the longitudinal ribs, half a line apart.

Fenestrules more or less oval near base, oblong oval near the middle of the expansion, slightly wider than longitudinal

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* In quoting Keyserling's species of *Polypora obicribrata*, (Vol. I., p. 237, Trans. Acad. of Sci., St. Louis,) it was printed "*obieribrati*" by an oversight; and in describing *P. Varsoviensis*, the words "two to three pores to each fenestrule" were accidentally omitted.

rays; in a space of two lines longitudinally, there are three and a half fenestrules, and six to seven transversely.

Cell-pores large, round, or oval, and round-lipped; when perfect, generally five to each fenestrule, except near the base, where the fenestrules are shortened by age.

Reverse minutely granular, or striate when worn, base having many single and some branching pedicles, stayed by lateral bars, which supported it when tossed by the tumultuous sea, in which it resided; its pedicles shoot downward like the rootlets of the Banyan-tree of India.

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" 1 *a*.—The same much magnified (ideal).
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PLATE XVI.

Fig. 1.—Coscinium cribriformis.
" 2.—Polypora Mexicana.
" 2 *a*.—Same, magnified cells (ideal).

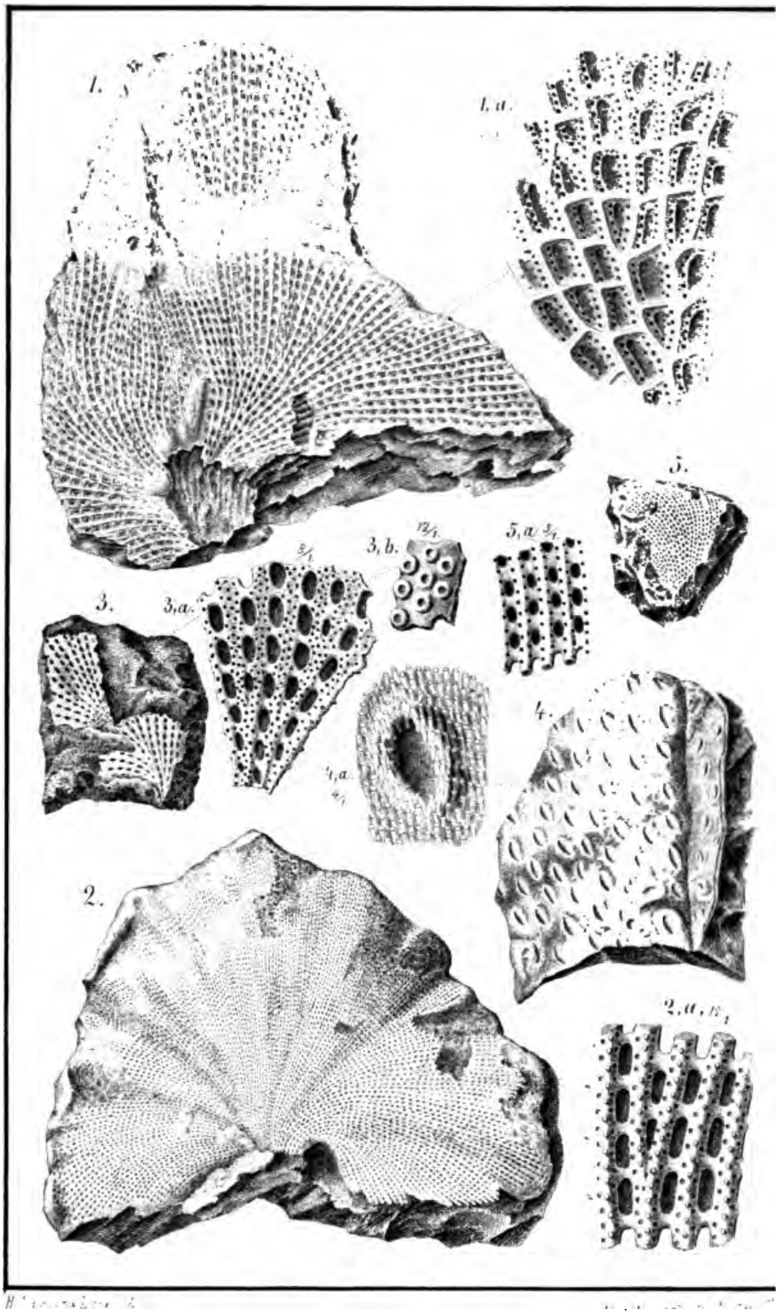
Fig. 2 *b*.—Same, surface without cells magnified.
" 3.—Polypora Shumardii.
" 3 *a*.—Reverse magnified.
" 3 *b*.—Medallion face magnified (ideal).

PLATE XVII.

Fig. 1.—Semicoscinium rhomboideum.
" 1 *a*.—Fenestrules enlarged.
" 1 *b*.—Tortuous tubes enlarged.
" 1 *c*.—End view of the sole (ideal).
" 1 *d*.—Cell structure (ideal).
" 1 *e*.—Terraced appearance of cells broken off near sole.
" 1 *f*.—Fig. of the same.
" 2.—Flustra spatulata.
" 2 *a*.—Encrusting tuberculations on another fossil.
" 2 *b*, 2 *c*.—Enlarged views of structure.
" 3.—Flustra tuberculata, nat. size.
" 3 *a*.—Same magnified.
" 3, *b*, *c*, *d*.—Cells much enlarged, showing tubercles.
" 3 *e*.—Side view of cells.
" 3 *f*.—Cells restored.
" 4.—Fenestella hemitrypa, nat. size.
" 4 *a*.—Same magnified.

PLATE XVIII.

Fig. 1.—Limaria falcata.
" 1 *a*.—Same, cells enlarged.
" 1 *b*.—Ideal view of same.
" 1 *c*.—Side view of cells.
" 2.—Septopora Cestriensis.
" 2 *a*.—Reverse.
" 2 *b*.—Medallion face enlarged.
" 2 *c*.—More enlarged.
" 3.—Polypora tuberculata.
" 4.—Fenestella banyana.
" 4 *a*.—Magnified view of radicles.
" 4 *b*.—Magnified view of fenestrules and cells.



1, *Fenestralia St. Ludovici.* — 2, *Fenestella plumosa.* — 3, *Polypora Varsoviensis.* — 4, *Coscinium Keyserlingi.* — 5, *Polypora intermedia.*

that can furnish them nourishment, even on their own branches and flowers. This is even the case with the most exclusive species, *C. Epilinum*, which attaches itself to all the weeds growing in flax fields, and may be cultivated on *Vicia*, *Impatiens*, and many other plants. Rich nourishment on succulent plants expands the organs, enlarges the flowers, increases the whole plant, and thus gives rise to varieties which at times have been distinguished as species; *C. Epithymum* in clover fields becomes what has been called *C. Trifolii; C. Europæa*, on vetches, *C. Viciæ; C. Gronovii* in shaded miry soil, on *Saururus*, *C. Saururi;* the overgrown form of *C. Africana* is *C. Capensis*, *etc.*

The *haustoria* (suckers) of *Cuscuta* deeply penetrate into the tissue of the nurse, and they, with parts of the stem imbedded in this tissue, are able to reproduce the plant after all external vestiges of the stem have been rubbed off. This the gardeners often have occasion to deplore in regard to a variety of *C. Epithymum* which has become a pest to some greenhouses in Europe; I have observed the same fact in different species which I have had under cultivation, especially in *C. inflexa*.

The species of *Cuscuta* naturally arrange themselves in three large groups, distinguished by their styles and stigmata.

1. Those with *two equal styles and elongated stigmata.* They are natives of the old world, exclusively, and have rarely and only temporarily been introduced with cultivated plants into America. (*C. Epilinum* with flax into some of our Eastern States, and *C. Europæa* with vetches in Hayti.) They may be termed *Cuscuta* proper. (*Cuscuta* and *Epilinella*, Pfeiffer, Bot. Zeitg. III. 673; *Cuscuta*, *Epilinella*, and *Succuta*, DesM. Et. pp. 38—41.)

2. Those with *two unequal styles, and abbreviated, usually capitate, stigmata.* They abound in America and Oceanica, and in the southern and eastern parts of Asia; a few species even penetrate into western Asia and southern Europe, and a single species is found in southern Africa. Cultivation has temporarily introduced one species into Europe (*C. racemosa* from Chili, under the name of *C. suaveolens*). This group may be comprised under the name of *Grammica*, a genus established by Loureiro in his Flora Cochinchinensis, I. 212, on a species belonging here. (*Engelmannia*, Pfeiffer, Bot. Zeitg. III. 673, not Torrey & Gray, nor Klotzsch; *Pfeifferia*, Buchinger Ann. Sc. Nat. IX. 88, not Salm-Dyck; *Buchingera*, F. Schultz in Jahrb. Pharm. 1847; *Cassutha*, DesM. Et. 40; *Grammica*, DesM. Bull. Soc. Bot. France, I. 295.

The flowers are mostly sessile and densely clustered, forming globose heads in the axils of single bracts without bracts in the inflorescence. The central flowers open first; the exterior ones are occasionally abortive. *C. Epithymum* has sometimes short pedicels, and *C. Babylonica* is always pedicelled. The corolla always remains on top or around the capsule, never at its base. Epistamineal scales are always present, though sometimes very thin and small, and easily overlooked.

The species of this group inhabit Europe, western and central Asia, and northern Africa to the Canary Islands.

§ 1. Styles longer than ovary.

1. C. Babylonica, Aucher! mss.; Choisy! Cusc. 174, t. 1, f. 1; DC. Prod.IX. 453. *C. peduncularis*, Kotschy! in sched.—Well characterized by its pedicelled flowers, truncate calyx and almost entire scales; approaching by its inflorescence to those other Asiatic species, comprised in the section *Epistigma*.—Bagdad, Aucher-Eloy! 1420 and 3183; on the Tigris, Noë! in Kurdistan, Kotschy! 388, a.

Var. elegans, *C. elegans*, Boiss. & Balansa! Diag. or, II. 3, 129, from the alpine regions of the Taurus, Balansa! 708; scarcely distinct from *C. Babylonica* except by the papillose prettily rose-colored flowers, and by the scales being a little more dentate and somewhat incurved.

2. C. Epithymum, Murray in Lin. syst. ed. 13. *C. Europæa*, β Lin. sp. 180. *C. minor*, Bauh, pin, 219. DC. Fl. fr. III. 644. DC. Prod. IX. 453. *C. filiformis*, β, Lam. Fl. fr. II. 307.—To this well known and common European species some authors have assigned all the different forms I am going to enumerate below, while others have separated several of them as distinct species; others, again, have united with it a number of other forms which I must consider distinct, especially such as I class with *C. planiflora;* some have even mixed up with it the very distinct *C. Europæa.*

It is certainly difficult to make precise the limits of *C. Epithymum* and *C. planiflora*, and some forms which I class under var. *Kotschyi* of the former, and others which fall under var. *approximata* of the latter, apparently are more closely allied than the extremes of either species among themselves; while the common *C. Epithymum*, especially the form known as *C. Trifolii*, is as distinct as can be from Tenore's original *C. planiflora.* I arrange the different forms in the following order:

Var. α. vulgaris, the common form of central Europe extending west to Great Britain, north to Scandinavia, south to northern Spain (Bourgeau! 655), northern Italy (*C. acutiflora*,

duced almost to a point; it runs in the direction of the interior angle of the seed (*longitudinal*, DesM.), or at right angles with it (*transverse*, DesM.), or it has an intermediate, oblique direction. In some sections I find these characters sufficiently distinct; in others they seem to be less reliable; in the American *Cuscutæ* I have often found them intermediate, and variable, often in seeds from the same capsule. Wherever only one or two seeds in a capsule come to maturity their shape becomes less distinct, and offers no good characters. It is scarcely necessary to add that only ripe seeds ought to be examined; unripe ones, especially when pressed hard, have led to the strangest mistakes; winged or margined seeds, described by authors, are such unripe seeds. Nearly ripe seeds are smoother and larger, when soaked, than ripe ones.

The embryo has been supposed to offer good characters; but I have reason to believe that those embryos with one or few circumvolutions (such as the one figured by Webb, Phyt. Can. III., pl. 142, fig. 14) are taken from unripe seeds.

Another character which I at one time relied on for generic distinction of *Cuscuteæ* is found in the calyx. Usually it is gamosepalous, but in some American species it is formed of entirely distinct and imbricate sepals, not different from the surrounding bracts—a character which prevails in *Convolvulaceæ* proper, where only one genus (*Wilsonia*) is gamosepalous.

The specific characters of *Cuscutæ* are found in the thickness of the stem, but principally in the inflorescence and in the different organs of the flower and fruit.

The inflorescence together with the presence or absence of bracts within it offers good characters, less so the presence or proportion of pedicels.

The shape and proportion of calyx and corolla and of their parts (tube and lobes) furnish important but not unchangeable characters. Their texture must also be studied, and often gives an important clue to the distinction of species.

It is unnecessary to repeat what has been said by former monographers about these points, but it may not be useless to indicate a few facts not so clearly stated by them.

The tube of the calyx, generally more or less campanulate or hemispherical, is angular in some species, the angles corresponding to the commissure, or to the midrib of the sepals. Its lobes are more or less deeply divided and are often auricled at base, and overlapping; these characters, however, are not very constant and reliable, as they not rarely depend on the rich nourishment and consequent vigorous growth of the parasite. The texture of the calyx is homogeneous in some species, and either fleshy or membranaceous, (often very thin, The *capsule* is either circumscissile, opening transversely by a regular joint, with thickened edges; or it bursts transversely with an irregular, jagged margin; or it remains closed (it is baccate, as it is termed), and either falls out of the persistent calyx, or it finally falls off with the calyx.

Between both styles of the ripe and dry capsule an opening is observed—the intrastylar aperture—parallel with or transverse to the dissepiment, more or less rhombic, formed by an incomplete separation of both carpels, which compose the capsule. This separation takes place in that triangular and thickest part of the dissepiment which lies next to and below the styles, and which, in the species with circumscissile fruit, adheres to the top, while the greater and thinner obcordate or bilobed part of the dissepiment remains attached to the base of the capsule in the bottom of the calyx.

In most instances the stylar portions of the dissepiment, as I will call this part, remain united at base, separating the funnel-shaped intrastylar aperture from the interior cavity of the capsule, and therefore can not give egress to the seeds, as has been erroneously stated. This is, I believe, the case with most or all American *Cuscutæ* (*Grammica*). In *Eucuscuta* and *Epistigma* the intrastylar aperture does communicate with the cells of the capsule, but the opening is far too small to let the seeds out; nor would this be necessary, as in all of them the capsule is circumscissile. In some few species I find each stylar portion of the dissepiment divided into two halves; in *C. pedicellata* these halves are widely distant from one another and adhere to the opposite halves, so as to form an opening into the capsule transverse to the dissepiment.

In *Monogynella* and *Callianche*, where the styles are united, there is, of course, no intrastylar opening, and in the former the entire dissepiment remains in the bottom of the capsule; in the latter, a small triangular stylar portion adheres to the top of the capsule, but, of course, without any opening.

Des Moulins was the first, in his "Études", to draw attention to the shape of the seed in general and the direction of the hilum in particular. Where all the four seeds are well developed, they are triangular, with a larger exterior convex and two smaller flat surfaces, the latter facing the dissepiment and the other seed of the same cell; the top of the seed is rounded or acutish; the base, with which it is attached to the placenta (which itself is dilated into a disc, often cup-shaped), is obliquely truncate or somewhat hooked, or rostrate, as Des Moulins terms it. Both flat faces of the seed are equal, or the one directed towards the dissepiment is larger than the other. At the truncate base of the seed, in the centre of a smooth and roundish umbilicus, is the hilum, forming a longer or shorter, narrower or broader linear groove, sometimes reduced almost to a point; it runs in the direction of the interior angle of the seed (*longitudinal*, DesM.), or at right angles with it (*transverse*, DesM.), or it has an intermediate, oblique direction. In some sections I find these characters sufficiently distinct; in others they seem to be less reliable; in the American *Cuscutæ* I have often found them intermediate, and variable, often in seeds from the same capsule. Wherever only one or two seeds in a capsule come to maturity their shape becomes less distinct, and offers no good characters. It is scarcely necessary to add that only ripe seeds ought to be examined; unripe ones, especially when pressed hard, have led to the strangest mistakes; winged or margined seeds, described by authors, are such unripe seeds. Nearly ripe seeds are smoother and larger, when soaked, than ripe ones.

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The tube of the corolla is cylindric or campanulate, or rather hemispherical or quite shallow, but never urceolate or ventricose during the flowering period; the swelling of the impregnated ovary, however, often gives it that shape. The laciniæ* of the corolla are of different shape, and direction, and proportion, and also sometimes auriculate and imbricate at base; their points are occasionally incurved, or their margins revolute, or involute; their margin, usually entire, is sometimes crenulate. The texture of the corolla is similar to that of the calyx, but never, I believe, verrucose, though often glandular. Its cellular structure will, yet, I suspect, offer good characters for some species, the cells being of very different size and shape in different species. The corolla, and sometimes the calyx, is occasionally covered with small papillæ, giving it a mealy appearance, which probably represent hair. This character, apparently so striking, is, however, of no more specific value than the pubescence in other plants, as I find papillose varieties of a number of European (*C. planiflora*, *C. Babylonica*) and American (*C. decora*, *etc.*) species, of course with intermediate forms. Of a single species (*C. capitata*), I know only the papillose form.

The calyx is always persistent; the corolla is deciduous only in the Indian *C. reflexa;* in all the other species it remains adhering to the capsule, either to its base, or, hood-like, to its top, or it completely envelops it, but it is not properly persistent; it is distended from the swelling of the capsule, but does not seem to grow. The position of the dead corolla is usually constant.

The stamens are mostly inserted in the very throat of the corolla, alternating with the laciniæ, but often exteriorly covered by their overlapping bases. In *Callianche* and *Monogynella* their point of insertion is usually below the throat, and the filaments very short. The filaments in the other *Cuscutæ* are more or less flattened, linear, or subulate; of different lengths, but usually much shorter than the laciniæ; they are rarely absent. The anthers are orbicular, ovate, oblong or linear, cordate or sagittate, blunt, emarginate or apic-

* I shall use the word *laciniæ* for the divisions of the corolla, and *lobes* for those of the calyx.

ulate, large or small; but their shape or size do not afford good and constant characters in this genus.

The most peculiar organs of the flower are the epistamineal scales, which are found in most of the species. The simplest form of that organ (in *C. inflexa*, *C. chlorocarpa*, *etc.*) exhibits a few teeth or lobes laterally adhering to the lower (attached) part of the filament. These lobes, in other species, expand into membranes, forming two lateral wings to the filament, crenulate or fringed at the tip and outside; then these wings partly unite at their upper end, thus forming a single bifid scale; finally they unite entirely, forming an oblong, ovate, spatulate or truncate, more or less crenate or fimbriate scale. Towards the base the scales are always "adnate in the middle," or, properly speaking, attached to both sides of the adnate filament. Their bases usually connect with one another, forming inverted arches.

In the following species these scales are wanting: *C. grandiflora* and *C. prismatica* of South America, *C. hyalina* of Asia, *C. Californica*, and *C. Sandwichiana*. In *C. Californica* the inverted arch alone is present, entire or fringed; in the others I find no trace of scales at all.

These scales are evidently lateral dilatations of the lower (attached) part of the filaments, perhaps of the character of stipules, as Prof. A. Braun suggests; or they are a sort of stamineal crown, attached at base to the corolla, but not a duplication of the same.

The presence, form and size of the scales furnish some of the best characters in this genus, but they are not entirely reliable; and while in some species they are very constant, in others they are found to vary considerably. It is doubtful whether a really scaleless form of *C. Europæa* exists; *C. Californica*, usually without scales, seems to occur also in a variety with scales.

The ovary and pistils are more reliable for the determination of species, just as they furnish the most important characters for the distinction of the sections. The walls of the ovary are of equal thickness throughout, or they are thickened towards the base of the style (furnished with a *stylopodium*, as I formerly designated this form.) The ovary is smaller than the tube of the corolla, or it fills its whole cavity, or even protrudes from it. The styles are subulate or terete, thick or capillary, and very constant in these differences; their length, however, is variable, and this character, so much relied on by Choisy in the subdivisions of this genus in his Monography and in DC. Prodromus, is of secondary importance, as the same species sometimes occurs with short or with long styles, and as the styles, included at first, often become exsert with age. The direction of the styles, in the flower and on the fruit, furnishes a tolerably good character.

The position of the dead corolla on the capsule has already been mentioned as a pretty reliable specific character. The shape and even the texture of the capsule also ought to be noted, though in several species (*C. Europæa*, for example) its form is quite variable.

The number of seeds which ripen in each capsule furnishes no distinction, though the species with very crowded flowers, and some others with loose flowers also, often develop only one or few seeds. The shape and surface of the seed ought to be studied more, and will, yet, it is believed, help to distinguish some species.

As almost all the characters enumerated above are subject to more or less variation, it is necessary to base the diagnosis of a species on a combination of a number of characters; but as the value of these characters is necessarily differently estimated by different botanists, some will consider as well marked species what others will look upon as mere varieties.

The different species often seem to have a predilection for certain plants, or families of plants, for their sustenance; and I have myself, at times, thought I discovered an influence of the mother plant (or, better, nursing plant, nurse) on the form and development of the parasite. But I have become fully convinced that this influence is very limited, and probably goes not even farther than the influence of different kinds of soil and manure would go with any other plant. If some species seem very constantly to prefer certain plants to others, (*C. Europæa*, *Urtica dioica*; *C. Epithymum*, *Calluna vulgaris*, or *Genista sagittalis*; *C. chlorocarpa*, *Polygonum*; *C. Gronovii*, *Cephalanthus*; *C. lupuliformis*, *Salix*; and, the most marked example, *C. Epilinum*, the flax fields,) it is probably because the kind of soil, the humidity or dryness, the shade or sun, and all the circumstances which suit the nurse, also agree best with the parasite. On the whole, succulent herbaceous dicotyledonous plants suit them best as nurses; some few species prefer low shrubs or semishrubs, and most of the *Monogynellæ* and a few others affect larger shrubs and trees, of course, penetrating only the tender bark of the smaller limbs.

Cuscutæ are found, also, on acrid or poisonous plants. I have seen them on *Ranunculaceæ*, on *Euphorbiæ*, on *Cicuta* and other *Umbelliferæ*, on *Rhus Toxicodendron*, and others; I have seen them, also, though sparingly and not very thrifty, on *Monocotyledoneæ*, such as *Liliaceæ*, *Gramineæ* and others, and even on the siliceous epidermis of *Equisetum*. The fact is, that, when once attached to a nursing stem, they throw out their branches and coil around any plant in the neighborhood, and strike their suckers into the tissue, and grow on any thing that can furnish them nourishment, even on their own branches and flowers. This is even the case with the most exclusive species, *C. Epilinum*, which attaches itself to all the weeds growing in flax fields, and may be cultivated on *Vicia*, *Impatiens*, and many other plants. Rich nourishment on succulent plants expands the organs, enlarges the flowers, increases the whole plant, and thus gives rise to varieties which at times have been distinguished as species; *C. Epithymum* in clover fields becomes what has been called *C. Trifolii; C. Europæa*, on vetches, *C. Viciæ; C. Gronovii* in shaded miry soil, on *Saururus*, *C. Saururi;* the overgrown form of *C. Africana* is *C. Capensis*, *etc.*

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The species of *Cuscuta* naturally arrange themselves in three large groups, distinguished by their styles and stigmata.

1. Those with *two equal styles and elongated stigmata.* They are natives of the old world, exclusively, and have rarely and only temporarily been introduced with cultivated plants into America. (*C. Epilinum* with flax into some of our Eastern States, and *C. Europæa* with vetches in Hayti.) They may be termed *Cuscuta* proper. (*Cuscuta* and *Epilinella*, Pfeiffer, Bot. Zeitg. III. 673; *Cuscuta*, *Epilinella*, and *Succuta*, DesM. Et. pp. 38—41.)

2. Those with *two unequal styles, and abbreviated, usually capitate, stigmata.* They abound in America and Oceanica, and in the southern and eastern parts of Asia; a few species even penetrate into western Asia and southern Europe, and a single species is found in southern Africa. Cultivation has temporarily introduced one species into Europe (*C. racemosa* from Chili, under the name of *C. suaveolens*). This group may be comprised under the name of *Grammica*, a genus established by Loureiro in his Flora Cochinchinensis, I. 212, on a species belonging here. (*Engelmannia*, Pfeiffer, Bot. Zeitg. III. 673, not Torrey & Gray, nor Klotzsch; *Pfeifferia*, Buchinger Ann. Sc. Nat. IX. 88, not Salm-Dyck; *Buchingera*, F. Schultz in Jahrb. Pharm. 1847; *Cassutha*, DesM. Et. 40; *Grammica*, DesM. Bull. Soc. Bot. France, I. 295.

3. Those with *styles united entirely or partly, and with capitate, ovate or conic stigmata.* The species of this group, all distinguished by their large size and thick stems, principally inhabit Asia; two extend into southern and eastern Europe, and two others are found in south Africa and southern North America. This group is Des Moulin's (Et. 39) *Monogynella*, with a little altered character.

The modifications in the form of the stigma and the dehiscence of the capsule furnish the basis for a further subdivision of the three principal groups. I will here only say, that in *Cuscuta* proper the capsule is almost always circumscissile; in *Grammica* it is often so, but more commonly it remains closed; in *Monogynella* it is constantly circumscissile.

The dead corolla covers the whole or the top of the capsule always, with a single exception (*C. Africana*), in the first; it is found on the top, or at the base of the capsule, in the second, and, if not deciduous, always on its top in the third group.

The following sections are proposed:

A. *Cuscuta Group.*

1. Eucuscuta. Styles nearly as long or longer and as thick or thicker than the filiform stigmata; capsule regularly circumscissile.
2. Epistigma. Subulate stigmata nearly sessile; capsule opening transversely without a regular jointed separation.
3. Clistococca. Subulate styles longer than the short subulate stigmata; capsule baccate.
4. Pachystigma. Cylindric or oblong stigmata thicker than the filiform styles; capsule bursting transversely.

B. *Grammica Group.*

5. Eugrammica. Stigmata capitate; capsule more or less irregularly circumscissile.
6. Clistogrammica. Stigmata capitate; capsule baccate.
7. Lobostigma. Top of clavate styles lobed at the upper stigmatose surface.

C. *Monogyna Group.*

8. Monogynella. Stigmata capitate or ovate, united, or distinct.
9. Callianche. Stigmata conic, or almost subulate; corolla large and deciduous.

Sec. 1. *Eucuscuta.*

Styles filiform, terminating in filiform stigmata of the same length or shorter, rarely longer, and of the same thickness as the styles, or thinner towards the end. Capsule regularly circumscissile by a joint, the line of separation being thickened. Usually all four seeds ripen; they are triangular, with an obliquely truncate base, the hilum forming a narrow perpendicular line.

The flowers are mostly sessile and densely clustered, forming globose heads in the axils of single bracts without bracts in the inflorescence. The central flowers open first; the exterior ones are occasionally abortive. *C. Epithymum* has sometimes short pedicels, and *C. Babylonica* is always pedicelled. The corolla always remains on top or around the capsule, never at its base. Epistamineal scales are always present, though sometimes very thin and small, and easily overlooked.

The species of this group inhabit Europe, western and central Asia, and northern Africa to the Canary Islands.

§ 1. Styles longer than ovary.

1. C. BABYLONICA, Aucher! mss.; Choisy! Cusc. 174, t. 1, f. 1; DC. Prod. IX. 453. *C. peduncularis*, Kotschy! in sched.—Well characterized by its pedicelled flowers, truncate calyx and almost entire scales; approaching by its inflorescence to those other Asiatic species, comprised in the section *Epistigma*.—Bagdad, Aucher-Eloy! 1420 and 3183; on the Tigris, Noë! in Kurdistan, Kotschy! 388, a.

Var. ELEGANS, *C. elegans*, Boiss. & Balansa! Diag. or, II. 3, 129, from the alpine regions of the Taurus, Balansa! 708; scarcely distinct from *C. Babylonica* except by the papillose prettily rose-colored flowers, and by the scales being a little more dentate and somewhat incurved.

2. C. EPITHYMUM, Murray in Lin. syst. ed. 18. *C. Europæa*, β Lin. sp. 180. *C. minor*, Bauh, pin, 219. DC. Fl. fr. III. 644. DC. Prod. IX. 453. *C. filiformis*, β, Lam. Fl. fr. II. 307.—To this well known and common European species some authors have assigned all the different forms I am going to enumerate below, while others have separated several of them as distinct species; others, again, have united with it a number of other forms which I must consider distinct, especially such as I class with *C. planiflora;* some have even mixed up with it the very distinct *C. Europæa.*

It is certainly difficult to make precise the limits of *C. Epithymum* and *C. planiflora*, and some forms which I class under var. *Kotschyi* of the former, and others which fall under var. *approximata* of the latter, apparently are more closely allied than the extremes of either species among themselves; while the common *C. Epithymum*, especially the form known as *C. Trifolii*, is as distinct as can be from Tenore's original *C. planiflora.* I arrange the different forms in the following order:

Var. α. VULGARIS, the common form of central Europe extending west to Great Britain, north to Scandinavia, south to northern Spain (Bourgeau! 655), northern Italy (*C. acutiflora*, Rota! and also Naples, to the Crimea, and reaching eastwardly far into Asia (Caucasus, Hohenacker! 409 and 1939, Altai, Ledebour! "Orient" Herb. Tournefort!) It varies considerably, especially in the size and proportion of the calyx and its lobes, and transition forms, uniting it with the other varieties, are not rare. I have paid some attention to the proportion of the stigma and style, but find no permanent character in them; the style proper is longer or shorter than the stigmatic portion; and this part is cylindrical or subulate in specimens not otherwise distinguishable; the stigma is usually pale brown-red, or, when dry, dark red, rarely yellowish.—*C. Trifolii*, Babington! sometimes so fatal to whole clover fields in England, France, Switzerland, Germany, and Sweden, is a luxuriant form, overgrown at the expense of the succulent herb, which it destroys.

Var. β. MACRANTHERA; *C. macranthera*, Heldr. & Sart.! in sched.; Boiss.! diag. or, II. 3, 126; *C. Calliopes*, Heldr. & Sart.! Boiss.! ibid, 128.—Large flowers on very short pedicels; calyx short, its ovate lobes scarcely covering half of the tube of the corolla; laciniæ ovate, acute or obtusish; anthers oval, large, often longer than the filaments; scales usually shorter than the tube, sometimes quite narrow.—A southern form, found on the southern declivity of the Alps, in Piedmont, Tyrol, Spain (Willkomm! 52, a), in southern France, in Italy (on the Apennines and in Corsica), in Greece and in the Crimea; I have also seen, in the Kew Herbarium, an English specimen of this variety, on *Ulex;* it has made its appearance in green-houses on *Erica* and other evergreen shrubs; this garden form is *C. xanthonema* of the Paris Jardin des Plantes.

Var. γ. ? OBTUSATA; this very curious form was collected by Funk! (Herb. Cosson and Hb. Reichenbach) in the Sierra Nevada of Spain on some shrubby *Genista;* the glomerules consist of 3-5 flowers, only, on pedicels longer than the calyx; lobes of calyx and corolla broadly oval, obtuse, shorter than the tube of the corolla; scales large; styles as in the common form. I would, at once, have acknowledged this peculiar plant as a distinct species, if a second specimen had not come to hand, collected by Heldreich on *Artemisia* near Koniah in the interior of Asia Minor, which approaches more to the ordinary form; flowers similar, but smaller, sessile, 6-8 in a small head; scales narrow; styles ordinary, seeds very small (0.3 lines diam.) The former may be distinguished as var. *macropoda*, the latter as var. *apoda*.

Var. δ. ? SAGITTANTHERA*; allied to var. *angustiloba*, distin-

* Philologists will blame this "vox hybrida," but daily experience teaches us and philological research confirms, that words are not formed

guished by the loose glomerules; pedicels as long as calyx; lobes of calyx obtusish, scarcely as long as tube of corolla; laciniæ lanceolate, acute; anthers broadly sagittate; scales large, crenulate; styles subulate at base, on the capsule almost horizontally divaricate.—Tunis, Kralik! in Herb. Cosson and Herb. Mus. Florent.—the only African form of the group of *Epithymum* seen.

Var. ε. ANGUSTATA; I distinguish by this name an Italian which assumes different shapes, described under different form, names. It has narrow and elongated lobes of the corolla and usually also of the calyx, which is commonly longer than the tube of the corolla; the flowers are numerous and sessile, or ordinarily more or less pedicelled. Three varieties may be distinguished.

Var. a. *alba*, with whitish stems, smaller flowers, membranaceous calyx. This is the true *C. alba*, Presl! Del. Prag. 87, also of Tenore and some other Italian botanists, while most authors apply this name to the original *C. planiflora*, Ten. Presl's description, copied by almost every subsequent author, is very erroneous; but his own specimens, on *Zizyphus*, preserved in his collection at Prague, and in the imperial Herbarium at Vienna, leave no doubt about the identity of the plant. *C. subulata*, Tineo! in Gussone Fl. Sic. II. 888, is exactly the same thing, as also *C. Gussoni*, Gasparrini! in Hb. It is a southern form occurring principally in Sicily, also about Naples and in Malta; it is often found on shrubs, and Sieber! (in Herb. Ledebour) gathered it on an oak.

Var. b. *angustissima*, flowers longer than in any other form seen ($2\frac{1}{4}$—$2\frac{1}{2}$ lines long), on short pedicels, with short calyx, slender elongated tube, narrowly lanceolate acuminate laciniæ, distinctly subulate filaments, and rather small scales. In fields of Medicago near Padua, Visiani!

Var. c. *rubella*, with red stems, larger flowers, red calyx of a thicker texture. This is *C. planiflora*, Koch fl. Germ., DesM. Et. 54, and many other authors, but not of Tenore. It has often been collected in southern Tyrol on *Colutea*, *Artemisia*, etc.; it also occurs in the Abruzzi and in Corsica.

Var. ζ. KOTSCHYI; *C. Kotschyi*, Des Moulins! Études p. 56, (not *C. Kotschyana* Boiss); *C. microcephala*, Welwitsch! in sched. Flor. Lusitan. nro. 1048.—This plant is perhaps the original *Epithymum* of the old botanists, as it often occurs on *Thymus* and othero small frutescent *Labiatæ*. It is well characterized by rather thick red stems, the

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according to theories, nor languages in the closet. The actual necessities of a living people are not bound by such rules of unity, as little as these prevail in the formation of nations, the present fashionable theory of political nationalities to the contrary notwithstanding.

small and dense glomerules, the closely sessile flowers, with long acute or acuminate lobes of calyx and corolla, and rather shorter styles than the common form of *C. Epithymum.* When the base of the calyx is elongated into a pedicel, it becomes the form just mentioned as *rubella.*—On the higher mountains of southern Europe, the southern declivity of the Alps, the mountains of the Dauphinée, the Pyrenees, the Sierra Nevada and other mountain regions of Spain and Portugal; in the Abruzzi of southern Italy, in the mountains of central Sicily, of Turkey, and of Greece.

Var. *scabrella* from Sicily, Gussone! and Arragon, Webb! is a papillose form of the same plant.

3. C. Abyssinica, Richard, Abyss. II. 78. *C. macrostyla*, Decaisne in Herb. Mus. Paris., seems to be well distinguished by the short and thick lobes of the calyx, the very long and narrow, erect laciniæ, the small, often bifid, scales and the very long capillary styles. These even surpass those of the last species, while the other characters, together with the crowded, closely sessile flowers, approach it to the next one. The typical form was collected on *Lantana;* another, with shorter laciniæ, was gathered on a leguminous shrub.

4. C. planiflora, Tenore, sensu latiori. This name has, like that of *C. alba*, suffered under the misfortune scarcely ever to be applied to the species, on which the author originally bestowed it! The difficulty was increased by an incomplete description and by Prof. Tenore himself inadvertently distributing under his new name a form of *C. Epithymum;* even now he preserves in his own herbarium, under this name, forms of several other species, besides the very specimen, described and figured by him as *C. planiflora*, easily recognized by the well figured *Plantago lanceolata* on which it grows. But this is not the only, nor the principal, cause of the difficulties under which botanists have labored in regard to this plant. It is probably the most variable of all the species of this genus, and appears under a larger number of forms than any other. Well may botanists differ from the view that I take in regard to this species, but it has not been adopted lightly. With 150 to 200 specimens from Europe, Africa, and Asia, before me, I have found it impossible to separate, specifically, the different forms here brought together; and even the subspecies, enumerated below, can not always be limited satisfactorily. On the other hand I find it difficult to keep this species, or complex of forms, as I am inclined to call it, separate from some allied species. Some varieties approach to *C. brevistyla* others to *C. Palæstina*, and others again are difficult to distinguish from the alpine form of *C. Epithymum* (*Kotschyi*).

The long list of synonyms properly belongs to the different subspecies; for the species, as I take it, no synonym, nor even a name, exists: the one adopted by me is the earliest one given to any one of the forms.

Synopsis of the forms of C. planiflora.

a. Lobes of the calyx more membranaceous than fleshy; laciniæ of the corolla turgid only at the points; styles much longer than ovary.

* Calyx cupulate, lobes usually broad and short, and, like the short laciniæ, cuspidate: Var. *approximata.*

** Calyx more deeply divided, its lobes and the laciniæ narrow, elongated, acute: Var. *Schiraziana.*

b. Lobes of the calyx thick and turgid; laciniæ turgid and often cucullate at tip; styles longer than ovary, usually shorter than or as long as capsule.

* Flowers larger; lobes of calyx united above the middle or almost to the point: Var. *Webbii.*

** Flowers usually smaller; sepals almost distinct.

† Flowers smooth: Var. *Tenorii.*

†† Flowers mealy or warty: Var. *papillosa.*

Var. *a.* APPROXIMATA; *C. approximata*, Babington! Ann. & Mag. Nat. Hist., 1844, pl. 4., and 1845 pl. 1.; A. Braun! Berl. bot. Zeitg., 1844, p. 542, and in Jahrb. d. Ver. f. N. K. Nassau, 1851, t. 1, f. 1; *C. urceolata*, Kunze! in Flora, 1846, p. 651; *C. cupulata*, Engelm.! in Bot. Zeitg., 1846, p. 276; *C. planiflora*, Kunze! in Flora, 1846, p. 655; *C. leucosphæra*, Boiss. & Heldr.! in sched. (afterwards referred by Boissier diag. or II. 127 to *C. urceolata*); *C. Asiatica*, Pallas! in Herb. H. Bot. Petropol.—The name, *approximata*, was given to this species for the closely approaching halves of the scales; yet, it more appropriately signifies the close alliance with the last species, and especially with its last mentioned variety. The original *C. approximata* was found in fields of *Medicago* in England, Germany and Switzerland, undoubtedly an imported plant, as Babington himself states, probably from India; or perhaps from southeastern Europe or Asia Minor. In this cultivated plant the flowers are larger (1¾–2 lines long) more attenuated at base, the scales appressed, short and often bifid. Similar forms, with numerous large flowers in large and very dense heads occur in Asia Minor, (Taurus, Kotschy! 357; Tmolus, Balansa! 414; Smyrna, Balansa! 412; Bithynia, Thirke!) in Greece (Taygetus! Parnassus! Thracia!) and in Piedmont (Herb. Link! Reichenbach fil.! The plants from the southwest seem to be a little smaller; Spain (Willkomm! 263 & 246; Bourgeau! 331, & 1299; Ph. Schimper!) Several specimens from the Canary Islands belong rather to this than to *C. Episonchum.* In the east this species has been found in Egypt (Fischer!) in Syria (Kotschy! 104) in Persia (Kotschy! 580, a.) and in the Himalaya regions (Hügel! Stocks! Hooker & Thomson!) The northern Asiatic form, which I had formerly distinguished under the name of *C. cupulata*, occurs in the Caucasus, the Altai, and, as it seems, throughout Siberia, (Ledebour! Godet! Becker! Karelin! 1721, etc.); flowers smaller in dense but small heads; calyx large, loose, almost entire, with broad and short lobes; scales comparatively large and incurved.

Var. β. SCHIRAZIANA; *C. Schiraziana*, Boissier! diag. or. I. 9, 86, has loose and few flowered heads, rather membranaceous flowers with the lobes of the deeply divided calyx and the laciniæ long and acute. The specimens examined by me, the same that Boissier described, were collected in Persia by Kotschy! and distributed under 118 and 318. In some the laciniæ are larger, in others shorter; scales larger and entire; or smaller, truncate and even bifid.—Link gathered a specimen of this form in Portugal on *Ulex nanus*, which has even longer lobes and a more deeply divided calyx than the Persian plant.

Var. γ. WEBBII; *C. Episonchum*, Webb! Phyt. Canar. III. p. 36, t. 141; *C. Epiplocamum*, Webb! in Pl. Bourgeau, 1430. —This, together with *C. calycina*, Webb, another form of this species, seems to be the only native *Cuscuta* of the Canary Islands, though the Herbaria show the names of *C. Europæa* and *C. Epithymum* from thence; *C. Epilinum* has been introduced there. It has been collected by Webb! Bourgeau! 18, 426, 459, 1430; De la Perraudière! Bolle! and others. I have seen the same form from Portugal, Deakin! Welwitsch! 192.—In *C. Episonchum* the lobes of the calyx are not as completely united as in *C. Epiplocamum*.

Var. δ. TENORII; *C. planiflora*, Tenore! Syll. Fl. Neap. p. 128 and Flor. Neap. III. p. 250, t. 220, f. 3.—If I am not mistaken, Kunze (Flora, 1846, p. 655, in Plant. Willk. nro. 303) was the only botanist who recognized Tenore's plant; every other author has bestowed the name on some other form of our plant or on some other species. *C. planiflora*, Koch! Germ. p. 570, and Reichenb. Fl. Germ. exsicc. nro. 2069, are forms of *C. Epithymum*.—Tenore's plant is most common in Sicily and north Africa, extending to the Canary Islands, to Spain, southern France, Italy and the Mediterranean islands, to Greece and Egypt, and undoubtedly also to Asia Minor and Syria. It is one of the smallest *Cuscutæ*, the heads are compact, 2–3 lines in diameter, white or rose-colored. The turgidity of the almost cylindric lobes of the calyx and of the laciniæ is very distinct even in the dried specimen, and very striking in the fresh or soaked one. Flowers often less than 1 line in length; grains very rough, 0.3–0.4 lines in diameter.—This is *C. alba* of most authors, but not of Presl; *Succuta*, DesM. Et. 41, is a genus founded on an immature specimen of the same plant; *C. Epithymum*, Gussone! Flor.

Inarim. p. 212, Cosson! in Plant. Bourgeau and of many authors on plants of southern Europe; *C. Europæa*, Bové! in Hb. Mauritan, 149; *C. bracteosa*, Gaspar.! in Hb.; *C. microcephala*, d'Escayrac! in Hb; *C. Godronii*, DesM.! l. c. 60, is a form with more acute lobes of calyx and corolla. *C. Sicula*, Tineo (fide spec. in the Hb. Cesati) is the same plant with lobes of the calyx a little broader; *C. calycina*, Webb! Phyt. Canar. III. p. 37, t. 152, has a larger calyx including almost entirely the corolla; *C. Canariensis*, Choisy! Mss. is the same thing.—It occurs in many published collections; besides those already mentioned it has been distributed by Bourgeau! 491, 1298, 1430,a. etc.; Aucher-Eloy! 1418; Huet de Pavillon! Palermo, etc.

Var. ε. PAPILLOSA is a peculiar form of the last subspecies, which thus far seems to have escaped observers; the whole flower is covered with semi-transparent papillæ; otherwise, I find no difference in specimens sent from Algiers to the Paris Museum by Balansa! But often the lobes are elongated and acute; so in the specimens from Tunis, Kralik! 410, Algiers, Cosson! Segovia, Hb. Gussone! A specimen from Arabia, Botta! in Hb. Mus. Paris, seems also to belong here. *C. globulosa*, Boiss. & Reut. is very closely allied to this form, and distinguished principally by the very short styles, and the globose corolla, the lobes of which cover the capsule; this form of the corolla does, however, occasionally also occur in specimens, which can not be separated from *C. planiflora*.

5. C. PALÆSTINA, Bossier! diag. or. I. 11, 86.—This pretty little species is closely allied to the last, to which the author himself subsequently referred it; but it seems to hold its rank with a number of other species of this genus, the limits of which are so difficult to ascertain. Tournefort (Cor. 45) already distinguished it under the name of *C. Cretica*; it is also *C. micrantha*, Tineo! in Gussone Fl. Sic. Syn. II. 887, not Choisy; and *C. capillaris*, Reichenb. Pl. Crit. V. 64. —It grows on small mostly shrubby plants, on arid hills in the Mediterranean region; in Sicily, Tineo! Morea, Bory! Attica, Heldreich! Creta, Sieber! Raulin! and other Grecian islands, Lefèvre! etc.; Palestine, Boissier! Gaillardot! Blanche!—Heads only about 2 lines in diameter, flowers ½–1 line long, usually 4, but often only 3-parted; only the central or primitive flower of the heads is often 5-parted; calyx comparatively large, with broad and short carinate lobes; top of laciniæ cucullate; scales rather large, broadly spatulate, incurved; styles somewhat longer than ovary.

§ 2. **Styles as long or shorter than ovary.**

6. C. BREVISTYLA, A. Braun! in Pl. Schimp, and in Rich-

ard Tent. Fl. Abyss. II. 79, is perhaps too nearly allied to *C. planiflora*, from some forms of which it is scarcely distinguished but by the short styles, which, in fruit, become divaricate. In the original Abyssinian specimens the lobes of the corolla are expanded, in some others they are closed over the capsule. The scales are short, thin and truncate or sometimes bilobed.—It has been found in Abyssinia, Schimper! III. 1486; on the Sinai, Botta! in Persia, Kotschy! 580; Affghanistan, Griffith! 686; Thibet, Hooker and Thomson! *C. elegans*, Noë! in Herb. 518 (not Boissier), from the Tigris, is the same plant.

Var. ? GLOBULOSA; *C. globulosa*, Boissier & Reuter! in sched., Boiss. in Diag. or. II. 3, 126; *C. Balansæ*, Boiss. & Reut. in sched.—This very pretty form at first sight looks very distinct; but Boissier himself already suggests the propriety of uniting it with "*C. alba*" (*planiflora*), and indeed its papillose flowers greatly resemble the var. *papillosa* described above; on the other hand it approaches *C. capitata*, but more in external appearance than in essential characters; the pretty red tinge of its flowers is occasionally found in both of these, and may be in some connection with the development of the papillæ.—The corolla closes over the capsule, giving the flower as well as the whole head an obtuse appearance; the scales in the original specimen are bilobed, in the other truncate; styles very short.—Mountain regions of Asia Minor: on the Tmolus, Balansa! 413; on the Taurus, the same! 707.

7. C. EUROPÆA, Lin. sp. 180, excl. var. β. This well known and well characterized species offers none of the difficulties of all the other European *Cuscutæ;* the obconic calyx with its thick and fleshy and usually elongated base and thin and obtuse lobes, the thin corolla with obtuse laciniæ, the small and very thin bifid or truncate appressed scales, the large ovary and comparatively large capsule with short divaricate styles and bearing the dead corolla only on top (not enveloped in it) readily distinguish it; nor does it vary near as much as the others do; the flowers, however, are as often 5 as 4-parted.

This species has given cause to a good deal of discussion in regard to the presence or absence of scales; but though I have examined a number of specimens said to have no scales, among others the original Var. *nefrens* of Sweden, I have never failed to discover that organ, though sometimes in a very defective state; I, therefore, can not doubt that it is always present, but frequently so small and especially so very thin as to escape detection. In dry specimens, soaked or boiled, it adheres to the tube of the corolla so closely, that it is scarcely possible to see or to separate it; but it is readily discovered and detached in the dry flower, if not too much mashed in pressing. The scales are rarely rounded, oftener truncate, and toothed at the apex, most commonly bifid, and fimbriate or toothed, or consisting of two distinct lateral dentate or entire, often extremely small, lobes.

The capsule is commonly depressed, but a form with an elevated, conic capsule, var. *conocarpa*, is not rare; both often grow together and can not be distinguished otherwise.

Var. *Indica* has more crowded, smaller flowers, and perhaps a little longer styles. A specimen from Sarepta on *Alhagi Camelorum*, in the Herbarium of the St. Petersburg Bot. Garden, has still smaller flowers, but shows no other, to me, appreciable difference.

Var. *Viciæ* has often a more solid texture of the flower and fruit, which last does not open before full maturity, and may thus in herbaria sometimes seem to be indehiscent, while, usually, the capsules of dried specimens readily open long before they are quite ripe. A specimen from Hayti has larger flowers, fruit and seed, than any other I have seen.

C. Europæa inhabits the greater part of Europe and the mountains of Asia to the Himalaya. I have seen no specimens from Africa, or from Spain south of the Pyrenees, from Sicily or Greece; in Italy it grows near Rome! and Naples! also in Asia Minor! on the Caucasus! in Persia! Affghanistan! Thibet! and on the Himalaya! in general. Once, only, it seems to have been seen in America; Poiteau! in Herb. Neufchatel, gathered it on *Vicia* in Hayti, where it no doubt was introduced from Europe.

The following formidable list of synonyms shows how much this species has exercised botanists.

C. major, Bauh. Pin. 219, DC. Fl. fr. III. 644; DC.! Prodr. IX. 452; C. *filiformis*, *a*, Lam. Fl. fr. II. 307; C. *tetrandra*, Mœnch Meth. 461; *C. vulgaris*, Pers. Syn. I. 289; *C. tubulosa*, Presl! Del. 215; *C. Epithymum*, Thuil. Fl. Par. 85, not Lin.; C. *Epicnidea*, Bernhardi Thur. Gartz. 1844, nro. 4; *C. halophyta*, Fries! n. mant. I. 8; *C. halophila!* Sum. Veg. I. 191; *C. monogyna*, Schmidt, Fl. Bohem. and in some herbaria, not Vahl.; *C. Ligustri*, Areschoug, Revis. Cusc. Suec. p. 17; *C. tetrasperma*, Jan! in sched.; *C. hyalina*, Boiss.! in sched., not Roth. *C. Segetum*, Rota in Giorn. bot. ital. II. 247, and *C. Viciæ*, Schultz, ap. DesM. are overgrown and often very destructive forms on fields of *Vicia*, *Medicago*, etc.—*C. Epitriphyllum*, Bernh.l. c. 1844, nro. 4; *C. Schkuhriana*, Pfeiff. Bot. Zeit., 1845, p. 673. *C. Europæa*, var. *nefrens* Fries! Sum. Veg. I. 191, and var. *vacua* Gren. & God., Fl. fr. II. 504, are names given to a supposed form without scales.—Var. *Pontica*, C. Koch in Linnæa XIX. 19, I have not seen. *C. brachystyla*, C. Koch! in Lin. XXII.

747, is a form with often patulous laciniæ and with conic capsule. *C. capillaris*, Edgeworth! Lin. Transact. XX. 68, is a more densely glomerate form from the Himalaya, with short laciniæ and very short bifid scales.

8. C. Kurdica, n. sp.: caulibus capillaceis; glomerulis parvis paucifloris bractea ovata acuminata suffultis; floribus arcte sessilibus plerumque 4-meris; calycis fere ad basin divisi lobis ovato-lanceolatis acutis crassiusculis tubum corollæ superantibus; laciniis ovato-lanceolatis erectis seu conniventibus (demum capsulæ arcte cinctæ adpressis) tubo fere longioribus; staminibus quam laciniæ multo brevioribus, antheris parvis subrotundis apiculatis filamento vix brevioribus; squamis basi tubi affixis parvis hyalinis tenuissimis truncatis; stylis ovario paulo, capsula depressa multo brevioribus.

On the Gara mountain, Kurdistan, Kotschy! Pl. Al. Kurd. 388, b. under the name of C. *minor*, fide Choisy and C. *alpina*, Hohenacker, in sched.; Kurdistan, J. Brant! in Hb. Hooker.—In texture and habit resembling C. *Europæa*, but scales even yet thinner; flowers fewer, more closely sessile; lobes of calyx and corolla acute; corolla on the fruit globose, closely investing the whole capsule; styles very short and slender, not as much divaricate as in the allied species.—Flowers 1 line long; seeds large in proportion, 0.5–0.6 lines long.

9. C. Persica, DeCaisne in Hb. Mus. Par.: caule filiformi; floribus sessilibus arcte glomeratis bractea ovata seu orbiculata suffultis; calycis campanulati lobis ovatis acutis corollæ tubum superantibus; laciniis tubo vix longioribus ovatis abrupte acuminatis sæpe papillosis, erectis demum patulis; staminibus brevibus; squamis spatulatis laciniato-fimbriatis faucem acquantibus incurvis; stylis brevibus subulatis vix ad medium stigmatosis in capsula tenuissima depressa corolla investita suberectis.

Ispahan, Persia, Aucher-Eloy! Herbier d'Orient in Hb. Mus. Paris, without number, apparently on some species of *Lactuca*. — A very distinct species, of which a single specimen only has come under my observation. The tough corolla totally invests and, as it would seem, supports the extremely thin capsule, just as in *C. capitata*, to which it is also allied by the subulate styles; scales larger than in any allied form, their fringes covering the top of the capsule.— Flowers 1½ lines long, seeds ½ line long, strongly reticulate.

10. C. Epilinum, Weihe, Archiv. d. Apoth. VIII. 54, (1824); DC. Prod. IX. 452; *C. densiflora*, Soyer-Willem. An. Soc. Lin. Paris I. 26 (1822) only by name; description l. c. IV. 281 (1826); *C. major*, Koch & Ziz, Cat. pal. 5; *C. vulgaris*, Presl, cech. 56; *Epilinella cuscutoides*, Pfeiff. Bot. Zeit. Oct. 1845, p. 673; DesM. Et. 64.—This well known and

very distinct species of the flax fields of Europe, (Russia! Sweden! Germany! France! England! Ireland! Spain! Sicily!) extends into the Canary Islands (Webb! Finlay!) and Egypt (Kralik! Figari!) and has also been seen in the eastern parts of the United States! I have seen no specimens from Asia, but Roxburgh's *C. aggregata*, Fl. Ind. I. 447, "introduced into the botanic garden of Calcutta with flax from Bagdad," is most probably the same thing.

The characters relied on for a generic separation of this species from *Cuscuta*, are untenable, or are founded on mistake. The calyx is deeply 5-lobed, not 5-sepaled; the capsule is constructed exactly as in the allied species; the dissepiment is complete till, at maturity, the larger, lower, obcordate part separates from the upper substylar portion. The intrastylar aperture penetrates into the capsule only at full maturity by a slit parallel to the dissepiment and sometimes by a second transverse one. The stigma is, at the flowering period, almost twice as long as the style, and at base of the same thickness, slightly tapering to an obtuse point; only in fruit, when the style is shrivelled, the stigma has the appearance of being club-shaped.

The very short style, the shape of the thick stigma and the structure of the stylar part of the dissepiment, indicate a close alliance to the Asiatic species, enumerated below, though all these have pedicelled, and not, like our species, closely sessile flowers. It is not improbable that it originally came from Asia or from Egypt.

Sec. 2. *Epistigma.*

Styles none or consisting of a very short knob on each half of the ovary; stigmata cylindric or subulate, usually of the length of the ovary. The capsule separates from the base only at complete maturity in a ragged line, not by a regular joint; the opening is wide (*C. pedicellata*) or very small (*C. Arabica*, *C. pulchella*); the emarginate dissepiment remains in the base of the capsule, as in *Eucuscuta;* the withered corolla closely coats the capsule.

The distinctly pedicelled flowers are disposed in loose or compact umbelliform clusters, few-flowered or crowded, supported by a single bract.

The species belonging here are all Asiatic; *C. Arabica* extends into Egypt, where it seems to be the most common form.

This group constitutes the connecting link between *Eucuscuta* and *Callianche*, another Asiatic form, in which the little remnants of the styles are united.

11. C. KOTSCHYANA, Boiss. Diag. or. I. 7, 29 (not *C. Kotschyi*, DesM.); well characterized by the large (2 lines long)

flowers with a large, loose, cup-shaped calyx and acuminate laciniæ; fruit unknown.—Southern Persia, Kotschy! 749. I refer here a specimen from the Herbarium of the St. Petersburg botanic garden, collected in Armenia by Szovits, though the flowers are a little smaller and the calyx is rather more deeply divided.

12. C. PULCHELLA, n. sp.: umbellis laxis paucifloris bractea ovata acuminata suffultis; calycis carnosi lobis ovatis acutis corollæ tubum subæquantibus; laciniis tubo fere æquilongis ovatis acutis papillosis crenulatis erectis seu patulis; staminibus brevioribus, antheris ovatis filamenta subulata æquantibus; squamis angustis faucem attingentibus fimbriatis incurvis; stigmatibus ovarium globoso-ovatum apice subconicum æquantibus; capsula corolla connivente tota involuta apertura parva basilari demum dehiscente.

Var. β. ALTAICA, calyce profundius fisso; laciniis acutioribus; squamis minoribus sæpe bifidis.

Affghanistan, Griffith! 688–691, in Hb. Hooker, on *Alhagi, Peganum, Artemisia*, etc. β. Sarepta! originally from the Hb. of Pallas, and Altai, Sievers! both in the Herbarium of the Botanic Garden of St. Petersburg; Griffith's plant, which may be distinguished as α. *Affghana*, has beautifully bright red stems and flowers; the very fleshy calyx especially is bright colored; umbels 4–6-flowered, pedicels as long as calyx or as the whole flower; flower 1⅓ lines long; capsule opening late and with a very small circular aperture. —From *C. Kotschyana* it is distinguished by the much smaller flowers with longer pedicels, the deeply divided calyx, the ovate and not acuminate laciniæ.—The Altaic specimens may possibly constitute *C. Asiatica*, Pallas, but the specimen in Hb. H. B. Petropol., labeled thus by himself, belongs to *C. planiflora*, var. *approximata*.

13. C. PEDICELLATA, Ledeb.! Fl. Altaic. I. 293. Icon. t. 234. DC. Prod. IX. 453, excl. syn.—The smallest flowered species of this section; flowers scarcely one line long, whitish, of very thin texture; scales small, truncate; styles almost united at base, separating in the ripe fruit; intrastylar aperture transverse to the dissepiment; top of thin capsule separating from the base with a very large opening, rather irregularly torn; more closely allied to the next than to both other species of this section; distinguished from it principally by the much smaller flowers and the wide opening of the ripe capsule. I have seen no other specimens but Ledebour's own, collected on the Altai, parasitic on some species of *Galium*; the other specimens referred to this species by authors do not belong here.

14. C. ARABICA, Fresenius! Pl. Ægypt. p. 165; Choisy! Cusc. 175, t. 1, f. 2, and DC. Prod. IX. 453; not of Wight;

Cassuta Arabica, DesM. Et. 72.—A well marked species, the most common one in Egypt and extending to the eastern shore of the Red Sea. It was collected in the former country by Bové! 354; Aucher-Eloy! 1418; S. Fischer! Kralik! and before all these by Lippi! in Hb. Vaillant, where it is labeled as "Cuscuta sulphurei coloris Ægyptiaca, flore niveo," etc. Arabia, on the Sinai, Rueppell! Schimper! nro. 140.—I can not see how it is possible to ascribe to it capitate stigmata, nor is the capsule exactly baccate; this last error, however, is easily accounted for, as only the fully ripe capsule will separate from the base, and with quite a small opening.—The Sinai plant, the original *C. Arabica*, has shorter pedicels, denser glomerules, cordate-sagittate anthers, and larger, even incurved, scales. Var. *Ægyptiaca* is distinguished by its longer pedicels, looser umbel, rather orbicular anthers, and smaller, often bifid, scales, which sometimes seem to be reduced to mere teeth; it may possibly be the luxuriant form, corresponding to *C. Trifolii* and growing on cultivated plants.

Sec. 3. *Clistococca.*

This group, represented by a single Asiatic species, is closely allied to *Epistigma*, but distinguished from it and all its other allies by the really baccate capsule, which at maturity separates from the persistent calyx, entirely covered by the closely enveloping corolla. The styles are subulate, much thicker at base, usually longer than the thin and pointed stigma. Flowers sessile, densely clustered.

15. C. CAPITATA, Roxb. Fl. Ind. I. 448; *C. rosea*, Jacquemont! in Hb.—Roxburgh's description, as far as it goes, agrees well enough with the species I take for it, which is, so far as I know, the only papillate Cuscuta in India; but it seems to be far from common there; it is, on the contrary, confined to the mountain districts and to an elevation of from 6 to 12,000 feet.—The lanceolate lobes of the deeply slit calyx and corolla are covered with hemispherical or subcylindric papillæ, consisting of numerous very minute cells. Scales in the lower part of the tube, not reaching to the middle, rounded or bilobed, dentate. Styles as long as ovary, much shorter than capsule. Capsule very thin and fragile, but strengthened by the dry corolla forming a tough coating over it; intrastylar aperture large.—Flowers over 1½ lines long, often rose-colored; seed oval, 0.6 lines long.

India "in great abundance on *Crotalaria juncea*," Roxburgh; on the Himalaya, on some *Artemisia*, Jacquemont! 1550; on *Thymus*, 7—10,000 feet high, Thomson! in Kumaun, 12,000 feet high, Strachney & Winterbottom! nro.

3, in part (in some herbaria the Indian form of *C. Europæa* is preserved under this number).

Sec. 4. *Pachystigma.*

Stigmata cylindric or oblong, obtuse, thicker than the filiform styles. Capsules bursting transversely, late, and not by a proper joint. Seeds compressed, indistinctly triangular, obliquely truncate at base, with a very short perpendicular or slightly oblique hilum.

Flowers pedicelled, disposed in a loose fascicled inflorescence; pedicels usually supported by bracts, only the latest ones naked. Corolla remaining on the top, or, in *C. Africana*, at the base of the capsule.

The three species of this group inhabit Southern Africa, and are usually parasitic on evergreen shrubs. The form of the stigma is intermediate between that of *Eucuscuta* and of *Grammica*, and the inflorescence is similar to that of the latter.

16. C. ANGULATA, n. sp.; caulibus filiformibus; bracteis lineari-lanceolatis; pedicellis capillaceis flore longioribus (ultimis brevioribus) ramosis laxe fasciculatis; calycis profunde 5-partiti ad commissuras alato-angulati lobis late ovatis obtusis tubum corollæ late campanulatum superantibus; laciniis corollæ ovatis obtusis demum patulis stamina æquantibus; antheris obtusis basi profunde cordatis filamento subulato vix brevioribus; squamis ovatis fimbriatis tubum fere excedentibus incurvis; pistillis ovario parvo depresso-globoso bis terve longioribus tubum excedentibus, stigmatibus cylindricis seu subclavatis stylo ipso brevioribus.—*C. Africana*, Choisy ! Cusc. 176 and DC. Prod. IX. 454, pro parte, fide spec. in Hb. De Cand. et cit. nec descript; *C. Africana*, c. Drege ! in sched.

Cape of Good Hope, Dutuitskloof, 3000 feet high, on *Staavia*, Drege! Mund & Maire! Harvey! in Hb. Hooker; Roxburgh! in Hb. Lambert, now Delessert.—The broad and short flowers with broadly oval and obtuse lobes and the 5-angled, or rather winged calyx, distinguish this species at first sight from both its allies. Choisy has confounded it with his *C. Africana*, as not only his reference to Drege's specimen but also his own label to this same specimen in DeCandolle's authentic herbarium prove.—Flowers about $1\frac{1}{4}$–$1\frac{1}{2}$ lines long, $1\frac{3}{4}$ wide when fully expanded; styles usually longer than stigmata, only in very young flowers of the same length. Fruit and seed not seen.

17. C. NITIDA, E. Meyer! in sched.; Choisy! Cusc. 177, t. 2, f. 1 and DC. Prod. IX. 454.—Well distinguished by the broad and acute lobes of the calyx, the narrowly lanceolate acute laciniæ and the stigmata which usually are much longer than

the styles, rarely of the same length. Stamens half as long as laciniæ; incurved scales as long or sometimes longer than tube; capsule irregularly circumscissile.

This is *C. Africana, a.* Drege! *C. Africana*, Ecklon & Zeyher! 20, 77, 11, and 21, 1, 11; *C. Burmanni*, Choisy! Cusc. 177, & DC. Prod. IX. 454, is the same plant, as I have satisfied myself by a careful examination of the original specimen in Hb. Delessert. This specimen is further interesting as it bears the inscription "*C. Americana*," it would seem, in Thunberg's handwriting. This may therefore be the original plant, which Thunberg first took for Linnæus' *C. Americana* and afterwards named *C. Africana*, so that *C. nitida* would be the true Thunbergian *Africana;* but even if this be so, it will be better to leave the nomenclature as at present established, especially as quite probably Thunberg confounded both species. Another fact, bearing on this question, is, that in Jussieu's Herb., now in the Museum of the Jardin des Plantes, a specimen of *C. Chinensis* is preserved, labeled "*C. Americana, Thunb. C. B. Sp. Thunberg ded.*" So it seems that at one time Thunberg himself took *C. Chinensis* for his *Americana*, but as, so far as known, this plant does not occur at the Cape, it is quite possible that he brought this specimen from India or China, and confounded all those plants under one name. He does not mention *C. Chinensis* or any other *Cuscuta* from those regions.

C. nitida seems to be one of the commonest species at the Cape of Good Hope, and has been collected there by almost every botanist. Dr. R. C. Alexander communicated a specimen with firmer red stems; some of Drege's specimens exhibit a granulated, somewhat scabrous, calyx.

18. C. Africana, Thunberg? Fl. Cap. 568 & Phyt. Bl. 17; Choisy! Cusc. 176 & DC. Prod. IX. 454 pro parte.—I have above stated my doubts about the identity of Thunberg's plant, and my reasons, nevertheless, for retaining his name for this species, The older botanists also seem to acknowledge this for *C. Africana*, as I find a specimen, thus labeled, in Willdenow's Herb. nro. 3161. Choisy's description entirely refers to this plant, though one of the specimens, he cites, belongs to *C. angulata*.

It is well characterized by the very loose inflorescence, the long pedicels, the capillary styles which are much longer (often more than twice as long), than the oblong and thick divergent stigmata; calyx short, lobes broad, obtusish, verrucose, imbricate; laciniæ linear-oblong, obtusish, involute at the margin and at tip, erect or spreading; scales large, often longer than the tube, incurved; capsules in the only specimen, in which I could find any, almost baccate, or opening very late, with the corolla persistent at base, mostly with a single globose seed, 0.7 lines long; flower 1–1½ lines long.—*C. Americana*, Thunb. Prod. 32, not of Linnæus, is the same as his later *C. Africana*.—Our plant was collected by Drege! 7010 and labeled by him *C. Africana, d;* it is Ecklon & Zeyher's! 22, 70, 10. *Schrebera schinoides*, Lin. sp. 1662, is, as the figure in Nov. Act. Ups. I. t. 5, f. 1, shows, this species, parasitic on *Myrica Africana*. *C. fusiformis*, Willd. rel. in R. & S. VI. 209, referred here by Choisy, a misprint for *C. funiformis*, as spelt in Willd. Herb. nro. 3156, is not a *Cuscuta* but a *Cassyta* from the Cape, as Schlechtendal has long since stated.

C. Capensis, Choisy! Cusc. 175 t. 1, f. 4, and DC. Prod. IX. 454, is a large form of this species; flowers 2¼–2¾ lines long, calyx smoother and shorter, laciniæ longer, somewhat acutish, scales smaller; it bears the same relation to *C. Africana* that *C. Trifolii* does to *C. Epithymum*.—Drege! 7833, Dr. Thom! Dr Alexander!

Sec. 5. *Eugrammica.*

Styles of unequal length, subulate or cylindric; stigmata capitate. Capsule bursting transversely more or less regularly; in *C. Jalapensis* regularly circumscissile. Seeds often only one or two in each capsule, rounded or flattened, truncate at base, or hooked; hilum forming a transverse or oblique, rarely a perpendicular line, often very short, or reduced to a point.

The inflorescence is quite variable, forming few-flowered loose cymes, or compound racemose or umbelliform cymes with pedicelled flowers, or compact clusters with subsessile flowers; with bracts at the base of each or at least the primary pedicels or flowers. The corolla remains at the base or on the top of the capsule or completely envelops it.

Most species of this section inhabit South America, the West Indies, and Mexico; one (*C. umbellata*) extends into the southwestern parts of the United States, and two (*C. odontolepis* and *C. applanata*) are peculiar to that region; two others are natives of Asia, one extending to New Holland, the other to eastern Africa.

§ 1. Subulatæ.

Styles thick and short, subulate from a broad base; flowers mostly large and of a firm texture; scales wanting in one (the first) species; corolla enveloping the whole or the greater part of the ripe capsule in all but the first; capsule opening readily by more or less regular circumscission.

* Lobes of calyx orbicular, imbricate.

19. C. GRANDIFLORA, Humb. Bonpl. Kunth! n. gen. sp. III. 123, t. 213; DC. Prod. IX. 457; not Wallich Cat. —This beautiful and striking species is so well described by Kunth that it is not necessary to add a single line. He already mentions (as he also does in regard to *C. Popayanensis*) the circumscissile opening of the capsule, ignored by later writers. The *raceme* of flowers on the left side of his otherwise very correct figure is imaginary, as the inflorescence is a loose few-flowered cyme. The flowers have a diameter of full 4 lines, and are 2½–3 lines high; the subulate filaments are inserted a little below the throat; no trace of scales visible; styles and capsule scabrous or verrucose; dry corolla at base of capsule; ripe seeds only 0.8 lines in diameter, almost globose, very rough; hilum a mere dot.

This species is peculiar to the Andes about the Equator; New Granada, Humboldt! Purdie! Goudot! Peru, Haenke! Cl. Gay! Weddell! 4768; Bolivia, Weddell! 4518; Chili, Edmonston!

20. C. ODORATA, Ruiz & Pavon! Fl. Peruv. I. 69, t. 105, f. a., not Choisy nor Pœppig; *C. intermedia*, Choisy! Cusc. 179, t. 2, f. 3 and DC. Prod. IX. 455; Gay, Fl. Chil. IV. 447.— After examining the original specimen in Hb. Ruiz, now in the royal Herbarium at Berlin, and the almost identical one in Hb. Pavon, now in the possession of E. Boissier of Geneva, which latter is the original for Choisy's description, I can have no doubt about the identity of these plants.—Flowers 3 lines long, 3–4 lines in diameter, on very short pedicels, forming dense lateral clusters; laciniæ rather longer than the shallow tube; scales very large, deeply fringed; corolla surrounding and partly covering the irregularly circumscissile capsule; seeds triangular-rounded, nearly one line long.—In the Flora Peruviana the capsule is already figured as circumscissile; but the whole figure, especially the details, are not very correct, and rather calculated to mislead.

Peru, Ruiz! Pavon! A. Matthews! 486; Weddell! 4693; Ecuador, Seemann! 852; Chili, Cl. Gay! 38 & 815.—In Weddell's specimen the tube is more cylindrical and longer and the lobes rather shorter, uniting this species with

Var. β. ? BOTRYOIDES, from southern Brazil, Lobb! 49, in the Kew Herbarium.—Dense clusters of flowers arranged in long pendulous bunches, resembling grapes; tube deeply campanulate, almost cylindric, nearly twice as long as the broad, rounded laciniæ; corolla enveloping the widely gaping capsule, the styles of which are shorter and thicker than in *C. odorata;* stylar portion of dissepiment broad and jagged.—

Loureiro! Cochin. 171; ed. Willd. I. 212.—A common plant, as it appears, of the tropical regions of Asia, and the islands southward, especially Ceylon, extending into Candahar (Griffith! 685) and China (in Hb. H. B. Petropol! as "*C. fimbriata*, Bunge," which name seems to be apocryphal), characterized by the strongly carinate rather than sulcate lobes of the thereby 5-angled calyx, with 5 secondary angles at the commissures; scales rather large, deeply laciniate, and not, as Choisy describes and figures them, short and adnate below the throat; styles slender; capsule very thin, enveloped and covered by the corolla, opening at base rather irregularly and late, and therefore often termed "baccate;" Loureiro himself describes the fruit of his genus *Grammica* as a "bacca," though his original specimen in the Hb. of the British Museum shows the circumscissile capsule. Flowers 1–1¼ lines long; seeds 0.5–0.7 lines long, oval; hilum oblique or usually nearly perpendicular.—Lamarck's original specimen, accidentally raised in the Jardin des Plantes of Paris, in 1784, with seeds supposed to have come from China, is preserved in Hb. Jussieu in Mus. Paris.

C. hyalina, Wight, ic. 1372; Wallich! Cat. 1320[1], not Roth, is a form of this species with bifid and rather small scales.

A form from the island of Nassibé, near Madagascar, Boivin! in Hb. Vindobon., has also bifid scales, but is distinguished from all other varieties by the capsule being exsert above the corolla and by the large intrastylar aperture.

Var. β. CARINATA; *C. carinata*, R. Brown! Prod. N. Holl. I. 491, from the tropical parts of New Holland, is the same species with more strongly carinate and more obtuse lobes of the calyx, more obtuse laciniæ and almost globose anthers.

Var. γ. CILIARIS; *C. ciliaris*, Hohenacker! in Pl. Kotschy, Boissier! diag. or. II. 3, 129, is a stouter, larger flowered northern form of the same plant, with shorter and stouter styles; scales spatulate, or sometimes in the same flower bifid, less deeply and finely fimbriate; flowers 1¾–2¼ lines long.—Mossul, Kotschy! 431; Kurdistan, Grant! in Hb. Torrey.—The specimen of Herb. Wight. propr.! 2408, is the same thing from India. The largest flowered form is preserved in Hb. Mus. Paris, under the name of *C. exigua*, collected at the Selenga river, in Siberia, by Demidoff, a cotemporary of Pallas; lobes of calyx and corolla, in this specimen, more distinctly crenulate than in most other forms of the species.

27. C. TINCTORIA, Martius! in Herb.: caulibus filiformibus subfunicularibus; floribus globosis pedicellatis in glomerulos laxos umbelliformes congestis; calycis cupulati lobis orbiculatis imbricatis tubum corollæ campanulatum æquantibus;

laciniis tubo æquilongis ovatis obtusis basi imbricatis erectis seu demum patulis reflexive; antheris ovatis filamento subulato brevissimo plerumque longioribus; squamis late ovatis fimbriato-laceris tubum æquantibus seu paulo excedentibus incurvis; stylis filiformibus ovario depresso longioribus fere exsertis; capsula irregulariter circumscissa corolla marcescente involuta tectaque.

Mexico, usually, as it seems, on trees: Oaxaca on *Schinus molle*, Karwinski! who relates that the natives use it under the name of "Zaca-tlascalli" as a yellow dye; and, indeed, the dried specimens tinge water, paper, etc., deep yellow, which I notice also in some other South American *Cuscutæ;* San Luis Potosi, on the same species of tree, Dr. Gregg! in full bloom in December.—Flowers 2–2½ lines long, in loose clusters, of 6 lines in diameter, which are gathered into long racemes; intrastylar aperture small; seed compressed, rounded, 0.6 lines in diameter.—The slender style and the shape of the capsule distinguish this species from the similar *C. Jalapensis*, the short flower and short style from *C. floribunda*, the circumscissile capsule and larger flower from *C. Gronovii*, and the short filaments from all of them; a specimen, however, in the Hb. H. Bot. of St. Petersburg, collected by Karwinski on an oak "between Victoria and the Rio Blanco" has filaments as long as the anthers.

** **Flowers elongated.**

28. C. FLORIBUNDA, Humb. Bonpl. Kunth! n. gen. sp. III. 123; DC. Prod. IX. 459.—The only specimens of this plant, known to me, gathered by Bonpland! at the bridge of Istla, in western Mexico, 3000 feet high, are preserved in the royal Hb. at Berlin and in Hb. Willdenow, nro. 3159[a]; they are in rather poor condition, and in ripe fruit only; enough is left, however, to show that the plant is nearly allied to *C. Popayanensis* as Kunth already states, but well distinguished by the short and thick, orbicular, deeply divided, broadly imbricate lobes of the calyx, the deeply divided corolla; the oblong linear, obtuse (not acute, as Kunth has it) laciniæ nearly equalling in length the cylindric tube; large oval scales deeply fimbriate-laciniate, reaching to the throat; styles twice as long as capsule, slender, long exsert in fruit; stylar portion of dissepiment elongated, almost reaching the base of the capsule; seed 0.8 line long, narrow, triangular and very rough. Flower with the lobes 3, or, when these are reflexed, 2 lines long. From *C. tinctoria*, to which it is even more closely allied, it may be distinguished by the long tube, the narrow laciniæ, the long styles, and the long and narrow seeds.

29. C. AMERICANA, Lin. sp. 180 pro parte; Jacq. Am. 30, p. 17; Choisy! Cusc. 186, t. 4, f. 4; DC. Prod. IX. 459.—This is the most common species of the West Indian Islands, parasitic mostly on shrubs and trees; it extends to the Pacific coast of Mexico, and on the Atlantic coast of South America from Venezuela to Brazil, rarely, as it would seem, leaving the neighborhood of the sea coast; though Weddell found it in the province of Goyaz in central Brazil.—Well characterized by the small, cylindric corolla, with short, very obtuse, almost always erect laciniæ slightly protruding over, or sometimes almost enclosed by, the wide and deep, cupulate calyx; scales short, attached to the middle of the corolla and usually not reaching to its throat; styles very slender, mostly much longer than the very small globose ovary, exsert only in fruit; capsule late and irregularly circumscissile; stylar portion of dissepiment reaching nearly to the base of the capsule; seeds mostly solitary, filling the whole capsule, roundish, somewhat compressed; hilum forming a very short line, almost a point.

The ordinary *C. Americana* has flowers $1\frac{1}{4}$–$1\frac{1}{2}$ lines in length; a thin, when dry, membranaceous and very wide calyx; scales truncate, sometimes almost bilobed, slightly dentate, or somewhat fimbriate; styles usually included during flowering, more or less exsert in fruit.—Martinique, Sieber! 91; Hayti, Poiteau! Ehrenberg! Antigua, Wullschlægel! with larger flowers; Porto Rico, Bertero! St. Thomas, Ridlé! Holton! Yucatan, Linden! Venezuela, Humboldt! Karsten! Fendler! 2069; Surinam, Hb. Ac. Phil.! Brazil, Gardner! 1775; Blanchet! 736; Goyaz, Weddell! 2208.

Different varieties may be distinguished according to the length of the pedicels, size of flower, texture of calyx, shape of scales and length of styles, but they run into one another so that I, with 25 or 30 specimens from the whole range of the species before me, am unable to limit even these varieties. The smallest form is *C. congesta*, Bentham! Bot. Sulph. 138, from Acapulco; flowers crowded; scarcely more than 1 line long; scales triangular, almost entire; styles slender. A similar plant was collected by Dr. Gregg at Mazatlan; flowers rather more slender, calyx narrower than in any other form, and more distinctly 5-angled (angles corresponding to the commissures); scales and styles as in the other. *C. leiolepis*, Miquel! Linnæa XVIII. 247, is the same thing from the orange hedges in Surinam, but with shorter styles than any other form of this species, examined by me. *C. Surinamensis*, Schilling, de Lepra p. 60 & 200, t. 2, also seems to belong here. *C. campanulata*, Nuttall! Mss. in Hb. Ac. Phil. from the West Indies, has the scales of this, but otherwise is identical with the ordinary form.

Another form has a thicker, more coriaceous calyx, usually larger flowers ($1\frac{1}{2}$–$2\frac{1}{4}$ lines long), larger more deeply fimbriate scales, often exsert styles, and sometimes two-seeded capsules. This is *C. spectabilis*, Choisy! Cusc. 187, t. 5, f. 1; DC. Prod. IX. 459, from Bahia, Salzmann! 351; Blanchet! 85, and *C. globulosa*, Bentham! Bot. Sulph. 138, from Acapulco; the specimens from Surinam, Hostmann! 464, one of Poiteau's! from Hayti, and especially Linden! 1994, from Cuba, the largest of all, may be referred here.

C. Americana, Lin. and of most authors on the Flora of North America, comprises besides this several North American species, especially *C. Gronovii*, *C. arvensis* and *C. compacta*. *C. Americana*, Thunb. is *C. Africana*.

30. C. CORYMBOSA, Ruiz & Pavon, as intended by the authors, is a rare form of a species which under different names is common throughout northern South America and Mexico. The species, as here proposed, is distinguished by the cupulate membranaceous calyx, with short and broad very obtuse lobes, loosely enclosing the lower part of the long cylindric tube of the corolla; laciniæ short, mostly very obtuse, erect or rarely spreading; anthers oval or orbicular-oval, sessile or on very short filaments; scales mostly long and narrow, attached for the greater part of their length, more or less fringed at the sides and apex, always considerably shorter than the tube, rarely quite small and indistinct; ovary small, globular or conic, with very long styles, which generally reach as high as the anthers, and often become exsert as the fruit ripens; capsule very small, often 1-seeded, always opening in its largest diameter, surrounded and covered by the base of the shrivelled corolla; stylar portion of dissepiment reaching nearly to the bottom of the capsule; hilum reduced to a point. Very closely allied to the last species but readily distinguished by the larger flowers, and the larger elongated and exsert corolla.

Var. *a*. GRANDIFLORA: flowers large, 3–4 lines long; anthers on very short filaments or sessile; scales long and narrow, almost entirely adnate, rarely bifid; styles reaching the anthers or shorter; ovary and capsule globose or rarely somewhat conic. *C. Popayanensis*, H. B. K.! n. gen. sp. III. 123; DC. Prod. IX. 460, of which Kunth already mentions the capsule as circumscissile, and speaks of the close alliance to *C. corymbosa*; *C. cymosa*, Willd.! rel. R. & Sch. VI. 205, founded on the same specimen.—New Granada, Humboldt! Columbia, Hartweg! 1237; Moritz! 489; Comitan, Mexico, Linden! 291; Carracas, Birchel! Gollmer! Venezuela, Fendler! 946; Peru, Dombey! in Hb. Mus. Paris, under the name of *C. corymbosa*.

The following forms do not seem sufficiently distinct from this: *C. patens*, Benth.! Bot. Sulph. 35, from the Magdalen Bay, Lower California, has rather wider and a little shorter flowers and shorter styles, which reach only as high as the linear scales.

C. inclusa, Choisy! Cusc. 179, t. 2, f. 2; DC. Prod. IX. 455, from Mexico, Berlandier! 1103; similar to the last, styles even longer, but scarcely reaching the throat; anthers sessile. Choisy's figure shows long filaments and his description speaks of "stamina basi corollæ affixa," etc., which is perfectly unintelligible. Choisy's figures are by no means reliable in the details, as is evident in examining, for example, the scales in his figures of *C. Arabica*, *Chinensis* and others, the ovary of *C. Gronovii*, *Americana*, etc. This is one of the few *Cuscutæ* known to me, where there is in the flower in full bloom a slight approach to the ventricose shape.

C. laxiflora, Benth.! Bot. Sulph. 138, from Acapulco, is the same plant, with a somewhat conic ovary and capsule, uniting this with the next form; flowers about 3 lines long, styles not exsert.

C. Popayanensis, Pœppig! Hb. is a variety of *C. micrantha*.

Var. β. STYLOSA; *C. stylosa*, Choisy! Cusc. 187, t. 5, f. 2; DC. Prod. IX. 459.—Flowers rarely more than 2 lines long, slender, with very short calyx; narrow cylindric corolla; short, narrow scales; filaments as long or shorter than anthers; styles reaching to the throat of the corolla or above it, often long exert at maturity of fruit or before; ovary and capsule conic or rather inversely pear-shaped. The length of the styles is variable, even in the original specimens, quoted by Choisy; the shape of the capsule would be characteristic enough, if intermediate forms did not indicate a transition to var. *grandiflora*.—Found, thus far, only in Mexico: Andrieux! 73 and 214; Berlandier! 822; Hb. Jacquin! under the name of *C. Americana;* Ghiesbrecht! 186; Toluca, Karwinski! Zimapan, Galeotti! 1412; Jalapa, Linden! 308 in part.

In the Kew Herbarium I find a specimen sent by Botteri from the Orizaba, Mexico (nro. 949), which is this form with scarcely exsert styles, larger flowers (3 lines long) and acutish crenulate laciniæ.

Var. γ. MICROLEPIS; *C. corymbosa*, Ruiz & Pavon! Fl. Peruv. I. 69, t. 105, b., not Choisy Cusc. nor DC. Prod.—Flowers 1¾–2 lines long, as often 5 as 4 parted in the original specimens in Hb. Ruiz and in Hb. Pavon, both of which seem to be parts of one and the same specimen; calyx cupulate with short obtuse lobes, half as long as the corolla; laciniæ ovate, obtuse, nearly one-third the length of the tube, erect or patulous; filaments as long as the broadly ovate-cordate anthers; scales reduced to very thin and small ovate membranes, with 4–7 or 8 irregular teeth, inserted below the middle of the tube; perhaps sometimes entirely wanting; ovary slightly conic, with styles scarcely reaching to the throat, just exsert in fruit. In the figure in the Flora Peruviana the cylindric corolla and the circumscissile capsule are correctly given.—Peru, on shrubs, and on *Medicago sativa*, Ruiz & Pavon! not found since.

It is well known that Choisy, l. c. and every author after him, myself included, took the *Cuscuta*, which twenty years ago made its appearance in different parts of Europe, in fields of *Medicago*, said to have been imported from Chili, for this species. The figure, as well as the original specimens, prove this to have been a mistake; that plant is *C. racemosa* Mart., as will be shown below. Whether the scales are ever really absent, or only very small and difficult to find, I can not say; in 8 or 10 flowers, which I carefully examined, I could not always discover them, especially after soaking the flowers; unfortunately the specimens are injured by too hard pressing. With the exception of the smaller flowers and indistinct scales, I find nothing to separate this from the other forms, which are more abundant and better developed, but had to yield their specific names to priority.

31. C. PRISMATICA, Pavon! Mss.; Choisy! Cusc. 182, t. 3, f. 2; DC. Prod. IX. 457.—A very distinct species, and one of the few without any scales. Choisy's figure as well as description is not very correct. Bracts lanceolate acuminate; flowers subsessile, 3 lines long; calyx elongated, obconic, fleshy, deep red, 5-angled from the decurrent carinæ of the unequal, ovate, acute or cuspidate imbricate lobes; corolla almost cylindric, long exsert, externally granulated, laciniæ 4–6 times shorter than the tube, oblong, obtuse, somewhat involute at the margins, crenulate; anthers ovate-cordate, sessile; ovary turbinate; capillary styles shorter than the tube, much longer than the ovary. I have seen no fruit of this plant, but venture to class it here on account of its close affinity with the last species, from which however it is abundantly distinguished by all the characters above enumerated. The only specimens seen are from Guayaquil, Pavon! in Hb. Boissier, and Hænke! in Hb. Mus. Bohem. Pr.

§ 3. *Leptolobæ.*

Styles slender, usually capillary; flowers rather small, membranaceous; lobes of calyx and corolla acute, often acuminate, commonly narrow and elongated, as long or longer than the usually campanulate tube; scales absent only in the last species; capsule surrounded or covered by the corolla, opening by irregular or rather regular circumscission.

32. C. ODONTOLEPIS, n. sp.: caulibus tenuiter filiformibus; floribus breviter pedicellatis bracteatis in glomerulos laxiores demum decompositos crassos confertis; calycis breviter campanulati profunde partiti nitidi lobis ovato-triangulatis acutiusculis tubum corollæ profunde campanulatum subæquantibus; laciniis ovato-lanceolatis acutis demum patulis reflexisve tubo paulo brevioribus; antheris ovatis filamenta subulata brevia æquantibus; squamis late ovatis e tubi basi oriundis ad medium adnatis faucem fere attingentibus versus apicem grosse dentatis; stylis capillaceis ovario depresso-globoso multoties longioribus e fauce paulo exsertis demum elongatis; capsula corollæ rudimentis calyptrata rite circumscissa.

Near a deserted Rancho on a rocky hill side in Arizona, parasitic on Amarantus; fl. Sept., Chs. Wright! 1624 (529).—"Whole plant very white." Clusters of the large and showy flowers at last crowded, more than 1 inch in diameter; flowers 2½ lines long, on pedicels as long or shorter than the calyx, which in one specimen covers the tube, and in another is shorter; scales large, irregularly toothed towards the apex only; capsule globose; readily opening towards the base by a small circular aperture; stylar portion of dissepiment scarcely half as long as capsule; seeds usually all 4 developed; oval, about ½ line long, verrucose, with a small, linear, vertical or transverse hilum.—In general aspect as well as in some particulars this species very closely approaches to *C. corymbosa*, but seems to be well distinguished by the characters given, especially the deeply divided corolla, its acute laciniæ, the broad dentate scales, the small basal opening of the capsule, the seed, etc.; it is not impossible, however, that intermediate forms may yet be discovered, which will oblige a future monographer to unite them. On the other hand, the similarity to *C. subinclusa*, a Californian species, which has decidedly baccate capsules, is so great, that one might be induced to doubt the diagnostic importance of this character.

33. C. XANTHOCHORTOS, Martius! in Hb.: caulibus filiformibus; glomerulis sessilibus globosis multifloris; bracteis ovatis; pedicellis ramosis, ultimis calyce campanulato profunde fisso brevioribus; lobis ovatis obtusis basi imbricatis margine sæpe reflexis tubum corollæ late campanulatum æquantibus seu superantibus; laciniis lanceolatis elongatis acutiusculis tubo multo longioribus patulis reflexisve basi imbricatis; antheris oblongis filamento subulato subbrevioribus; squamis late ovatis fimbriato-laceris faucem excedentibus; stylis capillaceis demum divaricatis ovario ovato multo longioribus; capsula conica corollæ rudimento involuta basi regulariter circumscissa.

Porto Alegre, Rio Grande de San Pedro, Brazil, Father Joannes de Sta. Barbara! in Hb. Martius.—The specimen consists of an intricate mass of deep yellow stems with few heads of flowers just developing; a few half ripe, but already circumscissile fruits were seen. Flowers 1½–2 lines long. This plant seems to be nearly allied to *C. umbellata*, but is distinguished by more compact heads, larger flowers, broad and imbricate obtusish lobes, etc. The laciniæ of the corolla, always elongated, are in some flowers acutish, in others almost obtuse.

34. C. PARTITA, Choisy! Cusc. 188, t. 5, f. 3; DC. Prod. IX. 460.—Brazil, Blanchet! 3047; Gardner! 2684; westward to Bolivia, Weddell! 3483 and 3611, and northward to Venezuela, Maracaibo, Karsten! and Curaçao, Friedrichsthal! 375, b; usually low, on herbaceous plants, *Leguminosæ*, *Malvaceæ*, *Euphorbiaceæ*, etc.—Cymes compound, paniculate; bracts ovate lanceolate, often crenate; flowers small, usually less than 1 line long, more or less glandulous and filled with coloring matter, deep-red, when dry, like *C. miniata*; calyx divided almost to the base, lobes lanceolate acute; lobes of corolla of same shape, at length reflexed with the points incurved; tube of corolla at last ventricose, enveloping the capsule, divided by grooves which correspond to the stamens into 5 separate externally convex compartments as it were; scales as long as the tube or shorter, deeply fringed; capillary styles much longer than the small globose ovary, subexert, sometimes recurved on the fruit; capsule very thin, hyaline, irregularly circumscissile with a wide opening; seeds 0.5–0.6 lines long, obliquely ovate, or, where only one in a cell is developed, rostrate; hilum linear-oblong, short, in the former seeds perpendicular, in the latter transverse.

The specimens from Bolivia have larger, less glandulous, and paler flowers, 1¼–1½ lines long, "yellowish-white or rose-colored," but do not differ in any other respect.

35. C. UMBELLATA, Humb. Bonp. Kunth! n. gen. sp. III. 121; DC. Prod. IX. 460; *C. parviflora*, Willd.! Hb. nro. 3163. This species seems to have been unknown to all later botanists with the exception of Torrey, who recognized Humboldt's plant in a specimen collected by Long's expedition to the Rocky Mountains. Lately it has turned up from many localities along the United States and Mexican boundary line, from northern Mexico and from the Antilles; in Brazil a form has been collected which I can not specifically distinguish from the Mexican plant.—The flowers of this species are arranged in loose compound fasciculate cymes, the ultimate divisions forming umbells of 3-5-7 flowers supported by a single ovate-lanceolate bract; pedicels usually longer than the flower; flower, with the lobes of the corolla erect, 1½–2 lines long; calyx broadly campanulate, thin and shining, at least when dry; lobes triangular, acute, as long or longer

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than the shallow tube of the corolla; laciniæ narrowly lanceolate, elongate, acute, longer than the tube, spreading or reflexed; scales usually broadly oval, large, longer than the tube, incurved; styles much longer than the globose-depressed ovary, rarely of same length; corolla enveloping the small thin depressed, almost 4-lobed capsule, which is commonly circumscissile, but in some instances rather irregularly bursting; seeds generally all 4 developed, 0.5–0.6 lines long, triangular, oblique, with a very short linear hilum.

It is always found in dry places on low herbs, especially *Portulacca*, also *Kallstrœmia*, *Amarantus*, *Atriplex*, *Polygonum*, etc., and sometimes even on some prostrate *Euphorbiæ:* between Queretaro and Salamanca, Humboldt! Saltillo and Camargo, Gregg! Western Texas, New Mexico and Arizona, Wright! 1627, 1636, 1639 (371, 510, 695), Bigelow! Schott! Santa Fé, Fendler! 659; foot of the Rocky Mountains, James! Jamaica, Broomfield! Purdie!

Dr. Hays found a specimen on the San Pedro River, Arizona, on *Suæda*, with much more dense inflorescence, greatly resembling a form of *C. Californica*, which will be noticed below, parasitic on the same saline plant, and mainly distinguished by the broadly campanulate, not turbinate, calyx, the circumscissile capsule and the seeds.

Some specimens from New Mexico show a tendency to papillose pubescence, and one from Sonora, Coulter! 1010, on some *Euphorbia*, has the unusually small flowers (1 line long) quite papillose-scabrous.

Var. β. ? Desertorum; *C. Desertorum*, Martius! in Hb.; pedicels long, flowers less crowded, smaller, 1 line long; lanceolate-linear laciniæ twice as long as tube; scales small, bifid or reduced to two lateral toothed lobes; styles shorter than the exsert capsule, which is circumscissile with a small opening; intrastylar aperture large; seeds only 0.4 line long.—On *Portulacca* and *Ehrenbergia* in the province of Piauhy, Brazil, Martius!—Another similar form, but with longer tube and shorter laciniæ and rather larger scales, was collected by Gardner! 2425, in the province of Ceara in the same neighborhood, also on *Portulacca*.

A specimen from the island of Antigua in Hb. Martius, Wullschlægel! 352, seems to belong here, though the (unripe) capsules do not open; flowers larger and more densely clustered than in the common form, calyx and capsule glandulous, intrastylar aperture large.

36. C. gracillima, n. sp.: caulibus tenuissime capillaceis demum deciduis; floribus in fasciculos decompositos demum dense glomeratos congestis; bracteis lineari-lanceolatis; pedunculis ramosissimis; pedicellis capillaceis flore gracili longioribus; calycis turbinati lobis lanceolatis sæpe apice recurvis

tubum corollæ paulo superantibus; laciniis lanceolatis subulatis tubo multo longioribus erectis apice subrecurvis; staminibus lacinias superantibus, filamentis e basi subulata capillaceis, antheris ovatis; squamis laceris fimbriatis incurvis tubum excedentibus; ovario parvo globoso, stylis capillaceis longissimis antheras fere attingentibus; capsula corollæ rudimento indusiata demum irregulariter transverse disrupta; seminibus lenticularibus læviusculis.—*C. fœtida*, Hook. & Arn.! Bot. Beechy, 304, non H. B. K.; *C. subtilis*, Chaubard! in Hb.

Mexico, Mornay! in Hb. Delessert; Tepic, Beechy! in Hb. Hooker; Jürgensen! in Hb. Mus. Florent.—The only species known to me with stamens longer than the lobes of the corolla; distinguished also by the large and dense masses (in one specimen over 1 inch thick and 2–3 inches long) of flowers; pedicels branched but scarcely umbellate, mostly much longer than the flowers; flowers small and slender, 1¼–1½ lines long; capsule opening late and irregularly; intrastylar aperture quite small; seeds usually two, 0.5 line long, compressed, rounded, slightly oblique at base, with a very short transverse or oblique hilum.—Closely allied to *C. umbellata*, principally distinguished by the inflorescence, the turbinate calyx, the smoothish seed; less important differences are the erect laciniæ and long filaments.

Var. β. SACCHARATA: bracteis pedicellis totoque flore papilloso-adspersis; laciniis staminibus stylisque brevioribus; seminibus minoribus.—*C. Sidarum*, Liebm.! in Hb.

On the coast of Oaxaca, parasitic on different species of *Sida*, Liebmann! in Hb. Hooker.—Inflorescence the same as in the species, flowers even smaller, 1¼ lines long, laciniæ shorter, stamens shorter, anthers orbicular, capsule readily circumscissile, seeds 0.4 line long.

37. C. LEPTANTHA, n. sp.: caulibus capillaceis; bracteis ovatis acuminatis; pedicellis filiformibus lævibus umbellato-fasciculatis; floribus 4-meris gracilibus; calycis granulato-hispidi lobis triangulatis acutis tubo corollæ cylindrico dimidio brevioribus; laciniis lanceolatis acutis erecto-patulis tubo multo brevioribus; filamentis filiformibus cum antheris ovatis brevioribus lacinias subæquantibus; squamis ovatis dentato-fimbriatis tubo multo brevioribus; ovario parvo globoso, stylis capillaribus longissimis demum exsertis; capsula corollæ basi hispidula indusiata calyptrataque circumscissa; seminibus globoso-triangulatis verruculosis.

Western Texas, Chs. Wright! 1849, nro. 522; prairies of the Leona, in the same region, the same! 1852, nro. 1639 in part (mixed with *C. umbellata*), in both instances on *Euphorbia albo-marginata*.—This is the only *Cuscuta* seen by me with (thus far) constantly 4-parted flowers. Flowers 2–2¼ lines long, pedicels sometimes twice as long; calyx campanulate-globose, short in proportion, about $\frac{3}{4}$ line long, as well as the base of the tube in all the specimens seen, papillose or, in the dry plant, scabrous; tube of the corolla slender, much longer than calyx; corolla enveloping the small capsule and contracted above it, capsule readily opening at base with a wide aperture; seeds 2–4, almost globose, 0.4 line long, with a very short hilum.

38. C. HYALINA, Roth! nov. spec. p. 100, not Wight, nor Boissier; *C. Arabica*, Wight, ic. t. 1371, not Fresenius; *C. oxypetala*, Boissier! diag. or. II. 3, 130; *C. acutissima*, Buchinger! Mss. in Pl. Schimper.—This well marked species of the tropical parts of the East Indies (Heyne! Stocks! 478; Hooker & Thomson! and others), extending into Abyssinia (Schimper! 1522) is certainly the plant Roth had in view, as the specimens with Heyne's and with Roth's own labels in the Hb. of the Bot. Garden of St. Petersburg prove; Roth's description, however, can not but have misled all future authors, as he speaks of scales, no trace of which is present in the different specimens I had occasion to examine, not even in Roth's own, nor are the flowers usually 4-parted, but almost always 5-parted.

Boissier l. c. already mentions that the capsule bursts irregularly; whether it more readily opens when fully ripe, is unknown, but in all the specimens examined it rather adheres to the base in the calyx, and bursts only when some force is used, the deeply bilobed lower part of the dissepiment remaining with the base. It therefore very properly comes in at the end of this section, uniting it with the next.

With *C. Californica* this species is closely connected, and, indeed, is sometimes difficult to distinguish from it; but the texture of all the parts is thinner, semitransparent and shining, at least when dry, hence Roth's name is quite appropriate; the adnate parts of the filaments are distinct, but no trace of scales is visible; the ovary is conic; the styles are still more hair-like and on the capsule divaricate; the seeds usually ripen all four, they are triangular, flattened, with the short, almost oblong hilum perpendicular or transverse, both forms being found in seeds from the same capsule.

Sec. 6. *Clistogrammica.*

Styles of unequal length, cylindric, rarely almost absent; stigmata capitate. Capsule never opening at base, baccate, persistent with the calyx, or separating from it entire; intrastylar aperture often large but generally not penetrating into the capsule. Seeds four in each capsule or fewer, sometimes only one; rounded or usually triangular-flattened, often rostrate; hilum linear, short or longer, transverse or oblique, or perpendicular.

Inflorescence variable; either an umbelliform or somewhat globose cluster with pedicelled flowers; or a loose racemiform or paniculate cyme, finally more or less crowded; or (in the 4 last species) compact and often continuous clusters of closely sessile flowers with many sterile bracts. The corolla remains either at base or around the capsule or covers its top.

This section is the richest in species, and the most common in North and South America and on the Islands of the Pacific; one species (*C. obtusiflora*) is a cosmopolite, being found in North and South America, Oceanica, Asia and Europe, and one (*C. appendiculata*) is peculiar to South Africa.

§ 1. **Platycarpeæ.**

Flowers pedicelled; sepals united; ovary and capsule globose-depressed with walls of uniform thickness, (in some forms of the last species conic.)

*** Flowers arranged in single or compound subglobose cymes; styles usually short and thick; withered corolla remaining at base of capsule.**

39. C. OBTUSIFLORA, Humb. Bonpl. Kunth.—Humboldt's plant is the type of a series of forms spread over a great part of the globe. The inconspicuous little species of the Peruvian Andes was not recognized nor sought for in the specimens found in widely distant parts of the globe; these, therefore, received distinct specific appellations, and different ones in different countries. They all are characterized by the bright orange-colored stems (which has suggested several specific names); the loosely globose inflorescence; the obtuse or rounded lobes of the calyx and the corolla, the laciniæ usually equal in length to the tube, and soon reflexed; the thick and at last subulate styles on the large and depressed ovary, which soon after flowering swells considerably, and, leaving the corolla at base, grows into a large, depressed, almost naked 4-seeded capsule, with a large intrastylar aperture of rhombic shape. Seeds 0.6 or 0.7 or even 0.8 line long, oval, oblique, with a long and narrowly linear perpendicular or transverse hilum running almost across the whole umbilicus. All parts of the flower are often, and the capsule commonly, glandulous-dotted. The principal, if not the only difference, I can discover between the different forms, here united, lies in the shape and size of the scales.

Synopsis of the forms of C. obtusiflora.

a. **Scales ovate or spatulate.**

*** Scales small, shorter than the tube of the corolla: Var. *vera*, from South America.**

**** Scales large, equalling or exceeding the tube of the corolla; all parts of the flower dotted with glands: Var. *glandulosa*, from the West Indies and the southern parts of the U. States.**

*** Lobes of calyx and corolla broadly oval, or almost orbicular; scales large: Var. *latiloba*, from India.

b. Scales bifid and often very small.

* Flowers 5-parted, usually glandulous; scales very small, sometimes almost obliterated: Var. *australis*, from New Holland and China.

** Flowers often 4-parted, scarcely glandulous; scales as in the last: Var. *breviflora*, from Southern Europe.

*** Flowers and scales larger; lobes of calyx and corolla narrower: Var. *Cesatiana*, from Italy and Central Asia.

**** Calyx large, cupulate, lobes somewhat carinate: Var. *Cordofana*, from Africa.

Var. *α.* VERA; *C. obtusiflora*, Humb. Bonpl. Kunth.! n. gen. sp. III. 122; *C. inodora*, Willd.! Hb. nro. 3164.—Flowers scarcely more than 1 line long; lobes of calyx very unequal, as in many other forms of the species; scales spatulate, very small and thin, but slightly fimbriate or crenate; capsule 1¼–1½ lines in diameter, dotted with, in the dry state, dark red glands.—Andes of Peru, Humboldt! Guayaquil, Jameson! 542; New Granada, Holton! 544, a specimen with more slender styles; Triana, Linden! 168; Antioquia on the Magdalena River, Jarvis! 1500. This last specimen, with a glandulous corolla and rather larger, more deeply fimbriate scales, forms a transition to the next.

Var. *β.* GLANDULOSA: Calyx, corolla and capsule dotted with red and shining glands; calyx shorter than tube in some and quite as large as that in other specimens; scales large, often exceeding the tube, deeply fringed, incurved; flower 1–1½ lines long; capsule 1½–1¾ lines in diameter.—Parasitic on *Polygonum* in most of the specimens examined; Georgia, Boykin! Florida, Rugel! 400; Louisiana, Tainturier! Western Texas, Wright! Bigelow! Schott! Bahama Islands, in Hb. Hooker! Cuba, Pœppig! under the name of *C. Americana*.

Var. *γ.* ? LATILOBA: flowers larger, 1½ lines long, of a more fleshy, or, when dry, coriaceous substance; calyx and capsule glandulous; lobes of calyx very unequal; these, the lobes of the corolla and the large, deeply fringed scales broadly oval, almost orbicular; styles short, thick.—Martaban, Wallich! Cat. 1320[3] under the name of *C. sulcata*.—It seems to differ from *C. obtusiflora* by the more fleshy erect lobes of the corolla, and especially by the more paniculate than globose inflorescence; but it certainly can not be united with *C. sulcata* (*Chinensis*), where Wallich and Choisy place it. The specimens are without fruit.

Var. *δ.* AUSTRALIS; *C. australis*, R. Brown! Prod. I. 491.—Flowers in this as in all the forms, enumerated above, 5-parted, scarcely more than 1 line long, dotted with glands all over; scales bifid or often reduced to one or a few lateral

teeth; styles short, usually more slender than in the American forms.—*C. Millettii*, Hook. & Arn.! Bot. Beechy 201, is the same plant, flowers rather less glandulous, styles stouter.—New Holland: Port Jackson, R. Brown! F. Bauer! Caley! Golbourn River, F. Mueller! Canton, China, Millett!—Mr. Mueller's specimen is almost destitute of glands and also of scales; only here and there single or bifid teeth are noticed at the base of the filaments; I can distinguish it from the following form only by its 5-parted flowers.

Var. ε. BREVIFLORA; *C. breviflora*, Visiani! Fl. dalm. II. 231; *C. Tinei*, Insenga! in Tin. pl. rar. sic. p. 14; *C. aurantiaca*, Requien! in sched., Bertol. Fl. it. VII. 623; *C. chrysocoma*, Welw.! in sched. DesM. Et. 71; *C. Regowitschiana*, Traut. Mel. biol. II. $\frac{14}{26}$ Mart. 1855, ex descr.—Flowers 1–1½ lines long, usually 4-parted or 4 and 5-parted in the same specimen, only partially glandulous, or entirely destitute of glands; scales very small, bifid, or commonly consisting of small lateral teeth, or sometimes almost abortive. On the lower Wolga, Liemaschko! 227; Becker! Kiew, Trautvetter; Constantinople, Boissier! Greece, Zuccarini! Berger! Dalmatia, Stalio! Alexander! Naples, Gussone! Capua, abundant in fields of hemp, Bruni! Syracuse, Insenga! Corsica, Requien! Toulon, Quillon! Montferrand, Ramond! Portugal, Welwitsch!—It is often found in gardens on Basilicum, and is probably often propagated and transported with the seeds of that plant; the Basilicum with the parasite is called in the gardens about Naples "Basilico con perrucche," just as the old Botanists used to call the grapes, to which *C. Epithymum* sometimes attaches itself, "Uva barbata."—In France this form has often been named *C. Europæa*, and DesMoulin, Et. p. 67, etc., confounds it with *C. suaveolens*.

Var. ζ. CESATIANA; *C. Polygonorum*, Cesati! in Cat. Sem. Gen. 1849, p. 22 & Linnæa XXIV. 199, not Engelm.; *C. Cesatiana*, Bert.! Fl. it. VII. 623.—Flowers 1¼ lines long, 5-parted, without glands; lobes of corolla narrow, longer than the tube; scales usually exceeding the tube, deeply laciniate and more or less bifid.—Piedmont, on *Polygonum*, Cesati! Cashmere, Jacquemont! 876.—The strange fact, that exactly the same form should be found a native of so widely distant localities, furnishes but another instance of the cosmopolitan habits of this species.—Prof. Cesati, l. c., gives the first correct account of the *apparent* intrastylar dehiscence of the capsule in the following words: "capsula ..... ob dissepimenti exsiccationem .. ... hians, ... hinc capsulam apice dehiscentem *mentiens*."

Var. η. CORDOFANA: calyx large, cupulate, longer than the tube of the corolla; its lobes united above the middle, somewhat carinate; scales as in var. *australis*; stamens and style

shorter than in any other form of the species.—Fezogl, Cordofan, Figari! in Hb. Mus. Florent.

40. C. CHLOROCARPA, Engelm.! in Gray Man. ed. 1, p. 350; ed. 2, p. 337; *C. Polygonorum*, Engelm.! in Sillim. Journ. 43, p. 342, t. 6, f. 26–29;* DC. Prod. IX. 461, not Cesati.—Along ponds and wet places, mostly on different species of *Polygonum*, and also on other plants of these localities; St. Louis, Missouri, Drummond! Lindheimer! Engelmann! Illinois, Engelmann! Wisconsin, Lapham! Indian country west of Arkansas, Bigelow! eastward thus far only in Delaware, Tatnall!—Closely allied to the last species, especially to var. *breviflora;* the principal difference lies in the triangular, acute lobes of calyx and corolla. Flowers usually 4-parted, about one line long; scales small, bilobed or oftener consisting of small lateral teeth; in a specimen from Delaware they are very incomplete, or sometimes almost wanting; large ovary filling the shallow tube of the corolla; capsule comparatively large, thin, membranaceous, of a greenish yellow color, whence the name, which I substituted for my former one, referring to the plants on which it is often found; this color of the capsule distinguishes it already at a distance from other species growing in the same region. Seeds 0.8 line long, oval, compressed, scarcely angled; transverse hilum rather shorter than in the last species.

41. C. ARVENSIS, Beyrich! in sched.; Engelm.! in Gray Man. ed. 2, p. 336.—The different varieties of this species are characterized by smaller flowers (often less than 1 line long) in more compound clusters, which approach in their form to those of the next species; lobes of calyx very obtuse; lobes of corolla almost always longer than the tube, acute or usually accuminate, reflexed and with the point inflexed; anthers broadly oval or rounded; scales large, deeply laciniate-fimbriate, often exceeding the tube; styles rather slender, as long as ovary, or longer; seeds 0.5–0.7 line long, oval or rounded, compressed, with a rather short, linear, often oblique hilum. The differences in the shape, size and texture of the calyx constitute the following varieties.

Var. *a.* PENTAGONA; *C. pentagona*, Engelm.! in Sill. Jour. 43, p. 340, t. 6, f. 22-24; DC. Prod. IX. 461; *C. arvensis*, Beyrich! in Hb.; *C. globularis*, Nutt.! in Hb.—Calyx thin and shining; lobes orbicular, as long or longer than the shallow tube of the corolla, forming, where they join, 5 projecting angles.—Dry barren soil or old fields on different *Compositæ*

* The article on American *Cuscutæ*, which originally appeared in Silliman's Journal, was reprinted in Hooker's London Journal of Botany, II. 184 t. 8, 1843, and in Schultz's Archives de Flore, 1855, p. 65.

or other plants, sometimes also on shrubs; from Virginia, Rugel! Sullivant & Gray! to the Carolinas, Schweinitz! Bosc! Beyrich! Curtis! Ravenel! and to Florida, Rugel! nro. 400, a. & b.

The western form, with shorter lobes of the less distinctly angled calyx was formerly distinguished by me as var. *microcalyx*.—In open woods, on dry soil, on *Solidago*, *Aster*, *Ceanothus*, etc., Illinois, Geyer! Missouri, Trécul! Riehl! Nebraska, Hayden! Indian country west of Arkansas, Bigelow! The latter has often as large a calyx as the eastern form.

Var. β. VERRUCOSA; *C. verrucosa*, Engelm.! l. c. p. 341, t. 6, f. 25; DC. Prod. IX. 461.—Calyx shorter than the campanulate tube, fleshy and glandular-verrucose.—On dry prairies, often on *Petalostemon*, but also on other prairie plants: Texas, Drummond! III. 247; Lindheimer! 127; Northern Mexico, Berlandier! 2457, to San Luis Potosi, the same! and Parras, Gregg!—Lindheimer's nro. 473 is an intermediate form between this and var. *pentagona*, mixed with a few specimens of the following.

Var. γ. PUBESCENS: pedicels and all parts of the flower or only the ovary and the capsule papillose-pubescent.—Western Texas, Lindheimer! Wright! 1635 (574.)—Wright's 519 and 523 (coll. 1849) are a transition form between this and the last variety, having the calyx of *verrucosa* and the ovary and capsule of *pubescens*.

Var. δ. CALYCINA: inflorescence often more compact; flowers rather larger; hemispherical calyx not angled, lobes rounded or oval, usually longer than the tube; lobes of corolla broader and shorter than in the other forms, and often not longer than the tube.—Texas, Lindheimer! 126, (a form from wet prairies, with smaller flowers); the same! 664; Wright! both on *Dianthera*, in or along water courses; Martinique, Mad. Richard! 114 in Herb. Mus. Flor.; Herb. Fauché! (now in Hb. Boissier); Saskatchawan, Drummond! *C. Americana?* Hook. Fl. N. A.; Oregon, Geyer! 674.

Specimens from Brazil Eschscholtz! in Hb. Ledebour; Gardner! 6068 in part, (*C. decora* has also been distributed under this number) differ somewhat from this variety by stouter and, in fruit, subulate styles; Gardner's specimens have also a smaller calyx.

** Flowers arranged in loose compound cymes; styles usually slender, as long or longer than ovary; withered corolla remaining at base of capsule or enveloping it.

42. C. TRICHOSTYLA, n. sp.: caule filiformi; bracteis ovatis obtusis; floribus breviter pedicellatis in cymulas ramosas subglobosas congestis; calycis cupulati fere ad basin divisi

lobis ovatis orbiculatisve obtusis basi imbricatis tubum corollæ campanulatum æquantibus seu superantibus; laciniis ovatis obtusis tubo æquilongis demum patulis reflexisve; antheris ovatis filamenta subulata brevia æquantibus; squamis late ovatis fimbriatis incurvis; stylis capillaribus ovario depresso multo longioribus e tubo vix exsertis.

Panama, Tweedie! Santarem, Brazil, on *Hyptis*, Spruce! 854, both in Hb. Hooker.—None of the specimens examined being in fruit, the true position of this species must remain doubtful. The large imbricate calyx, the slender styles, and especially the branching inflorescence, distinguish it from *C. obtusiflora;* the inflorescence the shape of the ovary and of the styles from *C. Gronovii* and *C. racemosa.*—Flowers $1\frac{3}{4}$–2 lines long, "white, with a strong odor of hawthorn," Spruce; exterior lobes of the calyx in the Panama specimen towards the tip verrucose-cristate; in the other smooth, thin and shining; scales in the former longer than the tube, in the other broader and shorter.

43. C. GYMNOCARPA, n. sp.: caule filiformi; floribus breviter pedicellatis umbellato-glomeratis; calycis lobis ovatis seu orbiculatis obtusissimis nitidis tubum corollæ æquantibus; laciniis triangulatis acutis erectis seu demum patentibus tubo æquilongis; antheris ovato-orbiculatis filamentum breve subulatum æquantibus; squamis tenuissimis late ovatis fimbriatis faucem attingentibus; stylis capillaribus ovarium depressum æquantibus supra capsulam globoso-depressam e corolla ad basin marcescente longe exsertam divaricatis patentibus recurvisve; seminibus oblique ovatis tumidis tenuissime sub lente reticulatis.—*C. Sandwicensis*, var. *Mimosæ*, Hook. fil. in Lin. Trans. XX. 205.

James Island of the Gallopagos group, in immense abundance on Mimosa bushes, Chs. Darwin! in Hb. Hooker.—Flowers about 1 line long, of a very thin texture; capsule $1\frac{1}{4}$–$1\frac{1}{2}$ lines in diameter, with a very small intrastylar aperture; seeds in the only specimen extant light yellowish brown, 0.6 line long, plump, nearly smooth, with a short, oblong-linear, usually perpendicular, hilum.—Much closer to *C. arvensis* than to *C. Sandwichiana;* distinguished from both by the short, broad and very acute lobes of the corolla, and by the very slender, at last nearly horizontal, styles; from the latter, also, by the presence of scales and by the naked capsule.

44. C. SANDWICHIANA, Choisy! Cusc. 184, t. 5, f. 4; DC. Prod. IX. 458.—Sandwich Islands; apparently the only species growing there; mostly on shrubs; Menzies! Eschscholtz! Gaudichaud! Matthews! Stewart! Maximowitsch! 57; Remy! 424.—Inflorescence a compound loosely flowered cyme; flowers pedicelled, 1–$1\frac{1}{2}$ lines long, "pallide ochracei" Maxim., of thin, membranaceous texture; only in Menzies' specimen

in Hb. Banks I find all the parts of the flower dotted with glands; lobes of calyx ovate, acutish; lobes of corolla acute and inflexed at tip or sometimes obtusish, often reflexed, but at last commonly appressed to the top of the capsule, which for its greater part is enveloped by the tube; anthers oval; no trace of scales; capsule 1¾–2 lines in diameter, with a small, almost circular, intrastylar aperture; styles stouter than in the last species, somewhat divaricate on capsule; seeds unusually large, 0.8–1.0 line long, verrucose-reticulate, triangular-ovate, somewhat oblique but not rostrate, with a short linear-oblong perpendicular hilum on the comparatively small regularly circular umbilicus.

45. C. ACUTA, n. sp.: caulibus subcapillaceis; cymis compositis laxifloris umbellulas mentientibus; pedicellis flore brevioribus bracteis ovatis acutis suffultis; calycis late campanulati membranacei lobis triangulatis acutis seu cuspidatis tubum corollæ campanulatum superantibus; laciniis lanceolatis acutatis tubo longioribus erectis seu subpatentibus; antheris oblongo-linearibus filamento subulato fere brevioribus; squamis ovato-spatulatis longe adnatis faucem attingentibus versus apicem crispato-fimbriatis; stylis capillaceis ovarium obovatum seu globosum æquantibus; capsula tenuissima corollæ rudimentis ad basin persistentibus indusiata apice libera stylis e basi lata subulatis paulo divergentibus coronata; seminibus 2–4 lenticularibus rugoso-reticulatis.

Chatham Island of the Gallopagos group; mostly on *Leguminosæ*, common on a low annual *Crotalaria*, but also on trees, such as *Parkinsonia* and *Mimosæ*, hanging down in massy festoons, Andersson!—Closely allied with both other Pacific species just described, distinguished from them by the very acute lobes of calyx and corolla and by the subulate styles; moreover from *C. Sandwichiana* by the presence of scales, and from *C. gymnocarpa* by the covered capsule and the direction of the styles; from *C. acutiloba* of the mountains of the neighboring coast and from *C. umbellata* it differs by the inflorescence, by the baccate capsule, etc.—Flowers 1–1¼ lines long; scales adnate nearly to the apex, crenulate on the sides, fringed only at tip; capsule about 1 line in diameter; intrastylar aperture large, forming a transverse slit; seeds only 0.5 line long, dark brown in the specimen before me; (perhaps not perfectly ripe) and strongly reticulate; hilum short, oblong-linear, perpendicular or oblique.—The specimens examined by me were all on a low *Crotolaria*.

*** Flowers arranged in branching paniculate cymes; styles slender, as long or longer than ovary; withered corolla surrounding the capsule or covering its top.

46. C. TENUIFLORA, Engelm.! in Gray, Man. ed. 1, p. 350;

globose, short in proportion, about ¾ line long, as well as the base of the tube in all the specimens seen, papillose or, in the dry plant, scabrous; tube of the corolla slender, much longer than calyx; corolla enveloping the small capsule and contracted above it, capsule readily opening at base with a wide aperture; seeds 2–4, almost globose, 0.4 line long, with a very short hilum.

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Sec. 6. *Clistogrammica.*

Styles of unequal length, cylindric, rarely almost absent; stigmata capitate. Capsule never opening at base, baccate, persistent with the calyx, or separating from it entire; intrastylar aperture often large but generally not penetrating into the capsule. Seeds four in each capsule or fewer, sometimes only one; rounded or usually triangular-flattened, often rostrate; hilum linear, short or longer, transverse or oblique, or perpendicular.

Inflorescence variable; either an umbelliform or somewhat globose cluster with pedicelled flowers; or a loose racemiform or paniculate cyme, finally more or less crowded; or (in the 4 last species) compact and often continuous clusters of closely sessile flowers with many sterile bracts. The corolla remains either at base or around the capsule or covers its top. This section is the richest in species, and the most common in North and South America and on the Islands of the Pacific; one species (*C. obtusiflora*) is a cosmopolite, being found in North and South America, Oceanica, Asia and Europe, and one (*C. appendiculata*) is peculiar to South Africa.

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** Scales large, equalling or exceeding the tube of the corolla; all parts of the flower dotted with glands: Var. *glandulosa*, from the West Indies and the southern parts of the U. States.

globose, short in proportion, about ¾ line long, as well as the base of the tube in all the specimens seen, papillose or, in the dry plant, scabrous; tube of the corolla slender, much longer than calyx; corolla enveloping the small capsule and contracted above it, capsule readily opening at base with a wide aperture; seeds 2–4, almost globose, 0.4 line long, with a very short hilum.

38. C. HYALINA, Roth! nov. spec. p. 100, not Wight, nor Boissier; *C. Arabica*, Wight, ic. t. 1371, not Fresenius; *C. oxypetala*, Boissier! diag. or. II. 3, 130; *C. acutissima*, Buchinger! Mss. in Pl. Schimper.—This well marked species of the tropical parts of the East Indies (Heyne! Stocks! 478; Hooker & Thomson! and others), extending into Abyssinia (Schimper! 1522) is certainly the plant Roth had in view, as the specimens with Heyne's and with Roth's own labels in the Hb. of the Bot. Garden of St. Petersburg prove; Roth's description, however, can not but have misled all future authors, as he speaks of scales, no trace of which is present in the different specimens I had occasion to examine, not even in Roth's own, nor are the flowers usually 4-parted, but almost always 5-parted.

Boissier l. c. already mentions that the capsule bursts irregularly; whether it more readily opens when fully ripe, is unknown, but in all the specimens examined it rather adheres to the base in the calyx, and bursts only when some force is used, the deeply bilobed lower part of the dissepiment remaining with the base. It therefore very properly comes in at the end of this section, uniting it with the next.

With *C. Californica* this species is closely connected, and, indeed, is sometimes difficult to distinguish from it; but the texture of all the parts is thinner, semitransparent and shining, at least when dry, hence Roth's name is quite appropriate; the adnate parts of the filaments are distinct, but no trace of scales is visible; the ovary is conic; the styles are still more hair-like and on the capsule divaricate; the seeds usually ripen all four, they are triangular, flattened, with the short, almost oblong hilum perpendicular or transverse, both forms being found in seeds from the same capsule.

Sec. 6. *Clistogrammica.*

Styles of unequal length, cylindric, rarely almost absent; stigmata capitate. Capsule never opening at base, baccate, persistent with the calyx, or separating from it entire; intrastylar aperture often large but generally not penetrating into the capsule. Seeds four in each capsule or fewer, sometimes only one; rounded or usually triangular-flattened, often rostrate; hilum linear, short or longer, transverse or oblique, or perpendicular.

in Hb. Banks I find all the parts of the flower dotted with glands; lobes of calyx ovate, acutish; lobes of corolla acute and inflexed at tip or sometimes obtusish, often reflexed, but at last commonly appressed to the top of the capsule, which for its greater part is enveloped by the tube; anthers oval; no trace of scales; capsule 1¾–2 lines in diameter, with a small, almost circular, intrastylar aperture; styles stouter than in the last species, somewhat divaricate on capsule; seeds unusually large, 0.8–1.0 line long, verrucose-reticulate, triangular-ovate, somewhat oblique but not rostrate, with a short linear-oblong perpendicular hilum on the comparatively small regularly circular umbilicus.

45. C. ACUTA, n. sp.: caulibus subcapillaceis; cymis compositis laxifloris umbellulas mentientibus; pedicellis flore brevioribus bracteis ovatis acutis suffultis; calycis late campanulati membranacei lobis triangulatis acutis seu cuspidatis tubum corollæ campanulatum superantibus; laciniis lanceolatis acutatis tubo longioribus erectis seu subpatentibus; antheris oblongo-linearibus filamento subulato fere brevioribus; squamis ovato-spatulatis longe adnatis faucem attingentibus versus apicem crispato-fimbriatis; stylis capillaceis ovarium obovatum seu globosum æquantibus; capsula tenuissima corollæ rudimentis ad basin persistentibus indusiata apice libera stylis e basi lata subulatis paulo divergentibus coronata; seminibus 2–4 lenticularibus rugoso-reticulatis.

Chatham Island of the Gallopagos group; mostly on *Leguminosæ*, common on a low annual *Crotalaria*, but also on trees, such as *Parkinsonia* and *Mimosæ*, hanging down in massy festoons, Andersson!—Closely allied with both other Pacific species just described, distinguished from them by the very acute lobes of calyx and corolla and by the subulate styles; moreover from *C. Sandwichiana* by the presence of scales, and from *C. gymnocarpa* by the covered capsule and the direction of the styles; from *C. acutiloba* of the mountains of the neighboring coast and from *C. umbellata* it differs by the inflorescence, by the baccate capsule, etc.—Flowers 1–1¼ lines long; scales adnate nearly to the apex, crenulate on the sides, fringed only at tip; capsule about 1 line in diameter; intrastylar aperture large, forming a transverse slit; seeds only 0.5 line long, dark brown in the specimen before me; (perhaps not perfectly ripe) and strongly reticulate; hilum short, oblong-linear, perpendicular or oblique.—The specimens examined by me were all on a low *Crotolaria*.

*** Flowers arranged in branching paniculate cymes; styles slender, as long or longer than ovary; withered corolla surrounding the capsule or covering its top.

46. C. TENUIFLORA, Engelm.! in Gray, Man. ed. 1, p. 350;

globose, short in proportion, about ¾ line long, as well as the base of the tube in all the specimens seen, papillose or, in the dry plant, scabrous; tube of the corolla slender, much longer than calyx; corolla enveloping the small capsule and contracted above it, capsule readily opening at base with a wide aperture; seeds 2–4, almost globose, 0.4 line long, with a very short hilum.

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capillary; ovary small, usually globose; capsule enveloped by the corolla; seeds often solitary, subglobose, slightly compressed, strongly hooked, 0.5–0.6 line long.

The different specimens examined vary considerably in the shape and length of the calyx, the proportion of the laciniæ to the tube, the length of the filaments, the indication of scales, the length of the styles and even the shape of the ovary.

Var. α. BREVIFLORA: flowers scarcely more than 1 line long, on short pedicels; laciniæ rather longer than tube; anthers, filaments and styles short; seeds several.—Monterey in fields, Hartweg! 1863.

Var. β. GRACILIFLORA: flowers slender, 1½–2½ lines long; calyx often shorter than tube of corolla; laciniæ as long as the tube, very narrow; filaments often short, or as long or longer than the linear-oblong anthers, styles as long or much longer than ovary.—California, Douglas! Fremont! 506; Bigelow!

Var. γ. LONGILOBA: Flowers 2–2½ lines long; calyx usually equal to the tube, rarely shorter, sometimes longer; laciniæ slender, sometimes twice the length of the tube; subulate filaments as long or longer than the oblong-linear anthers; styles very long and slender.—California, principally, as it appears, on the coast of the southern parts of the State and commonly on some species of *Eriogonum:* Sta. Barbara, Nuttall! San Diego, Thurber! 570 & 633; Newberry!

Var. δ. APICULATA: corolla somewhat granulate, ovary and 1-seeded capsule conic, apiculate; otherwise very similar to the last.—On the Colorado, Bigelow! in February.

Var. ε. ? SQUAMIGERA: flowers 2–2½ lines long, on pedicels shorter than the flower, or even the calyx, in rather crowded subglobose clusters; lobes of calyx lanceolate, acuminate, as long as the open, funnel-shaped tube of the corolla; laciniæ lanceolate, as long as the tube, at last spreading; anthers oblong-linear, cordate at base, on very short filaments; scales spatulate, fringed, shorter than the tube, incurved; styles as long as the very acute ovarium; capsule apiculate, 1-seeded, lower half enveloped by the tube of the corolla.—The more densely clustered flowers, the presence of scales and the acute ovarium would seem to specifically distinguish this form, but the last mentioned variety appears to unite it with the common form; perhaps it ought to be classed with the next species.—Saline soil on the Rio Virgen, Utah, on *Suæda*, J. Remy! in Hb. Mus. Paris.

§ 2. Oxycarpeæ.

Flowers subsessile, or pedicelled; sepals united; ovary and capsule thickened towards the apex, usually more or less conic.

*** Lobes of calyx and corolla broadly oval, or almost orbicular; scales large: Var. *latiloba,* from India.

b. Scales bifid and often very small.

* Flowers 5-parted, usually glandulous; scales very small, sometimes almost obliterated: Var. *australis,* from New Holland and China.

** Flowers often 4-parted, scarcely glandulous; scales as in the last: Var. *breviflora,* from Southern Europe.

*** Flowers and scales larger; lobes of calyx and corolla narrower: Var. *Cesatiana,* from Italy and Central Asia.

**** Calyx large, cupulate, lobes somewhat carinate: Var. *Cordofana,* from Africa.

Var. *α.* VERA; *C. obtusiflora,* Humb. Bonpl. Kunth.! n. gen. sp. III. 122; *C. inodora,* Willd.! Hb. nro. 3164.—Flowers scarcely more than 1 line long; lobes of calyx very unequal, as in many other forms of the species; scales spatulate, very small and thin, but slightly fimbriate or crenate; capsule $1\frac{1}{4}$–$1\frac{1}{2}$ lines in diameter, dotted with, in the dry state, dark red glands.—Andes of Peru, Humboldt! Guayaquil, Jameson! 542; New Granada, Holton! 544, a specimen with more slender styles; Triana, Linden! 168; Antioquia on the Magdalena River, Jarvis! 1500. This last specimen, with a glandulous corolla and rather larger, more deeply fimbriate scales, forms a transition to the next.

Var. *β.* GLANDULOSA: Calyx, corolla and capsule dotted with red and shining glands; calyx shorter than tube in some and quite as large as that in other specimens; scales large, often exceeding the tube, deeply fringed, incurved; flower 1–$1\frac{1}{2}$ lines long; capsule $1\frac{1}{2}$–$1\frac{3}{4}$ lines in diameter.—Parasitic on *Polygonum* in most of the specimens examined; Georgia, Boykin! Florida, Rugel! 400; Louisiana, Tainturier! Western Texas, Wright! Bigelow! Schott! Bahama Islands, in Hb. Hooker! Cuba, Pœppig! under the name of *C. Americana.*

Var. *γ.* ? LATILOBA: flowers larger, $1\frac{1}{2}$ lines long, of a more fleshy, or, when dry, coriaceous substance; calyx and capsule glandulous; lobes of calyx very unequal; these, the lobes of the corolla and the large, deeply fringed scales broadly oval, almost orbicular; styles short, thick.—Martaban, Wallich! Cat. 1320[3] under the name of *C. sulcata.*—It seems to differ from *C. obtusiflora* by the more fleshy erect lobes of the corolla, and especially by the more paniculate than globose inflorescence; but it certainly can not be united with *C. sulcata* (*Chinensis*), where Wallich and Choisy place it. The specimens are without fruit.

Var. *δ.* AUSTRALIS; *C. australis,* R. Brown! Prod. I. 491. —Flowers in this as in all the forms, enumerated above, 5-parted, scarcely more than 1 line long, dotted with glands all over; scales bifid or often reduced to one or a few lateral

teeth; styles short, usually more slender than in the American forms.—*C. Millettii*, Hook. & Arn.! Bot. Beechy 201, is the same plant, flowers rather less glandulous, styles stouter.—New Holland: Port Jackson, R. Brown! F. Bauer! Caley! Golbourn River, F. Mueller! Canton, China, Millett!—Mr. Mueller's specimen is almost destitute of glands and also of scales; only here and there single or bifid teeth are noticed at the base of the filaments; I can distinguish it from the following form only by its 5-parted flowers.

Var. ε. BREVIFLORA; *C. breviflora*, Visiani! Fl. dalm. II. 231; *C. Tinei*, Insenga! in Tin. pl. rar. sic. p. 14; *C. aurantiaca*, Requien! in sched., Bertol. Fl. it. VII. 623; *C. chrysocoma*, Welw.! in sched. DesM. Et. 71; *C. Regowitschiana*, Traut. Mel. biol. II. $\frac{1}{2}\frac{4}{8}$ Mart. 1855, ex descr.—Flowers 1–1½ lines long, usually 4-parted or 4 and 5-parted in the same specimen, only partially glandulous, or entirely destitute of glands; scales very small, bifid, or commonly consisting of small lateral teeth, or sometimes almost abortive. On the lower Wolga, Liemaschko! 227; Becker! Kiew, Trautvetter; Constantinople, Boissier! Greece, Zuccarini! Berger! Dalmatia, Stalio! Alexander! Naples, Gussone! Capua, abundant in fields of hemp, Bruni! Syracuse, Insenga! Corsica, Requien! Toulon, Quillon! Montferrand, Ramond! Portugal, Welwitsch!—It is often found in gardens on Basilicum, and is probably often propagated and transported with the seeds of that plant; the Basilicum with the parasite is called in the gardens about Naples "Basilico con perrucche," just as the old Botanists used to call the grapes, to which *C. Epithymum* sometimes attaches itself, "Uva barbata."—In France this form has often been named *C. Europæa*, and DesMoulin, Et. p. 67, etc., confounds it with *C. suaveolens*.

Var. ζ. CESATIANA; *C. Polygonorum*, Cesati! in Cat. Sem. Gen. 1849, p. 22 & Linnæa XXIV. 199, not Engelm.; *C. Cesatiana*, Bert.! Fl. it. VII. 623.—Flowers 1¼ lines long, 5-parted, without glands; lobes of corolla narrow, longer than the tube; scales usually exceeding the tube, deeply laciniate and more or less bifid.—Piedmont, on *Polygonum*, Cesati! Cashmere, Jacquemont! 876.—The strange fact, that exactly the same form should be found a native of so widely distant localities, furnishes but another instance of the cosmopolitan habits of this species.—Prof. Cesati, l. c., gives the first correct account of the *apparent* intrastylar dehiscence of the capsule in the following words: "capsula ..... ob dissepimenti exsiccationem .. ... hians, ... hinc capsulam apice dehiscentem *mentiens*."

Var. η. CORDOFANA: calyx large, cupulate, longer than the tube of the corolla; its lobes united above the middle, somewhat carinate; scales as in var. *australis*; stamens and style

*** Lobes of calyx and corolla broadly oval, or almost orbicular; scales large: Var. *latiloba,* from India.

b. Scales bifid and often very small.

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Var. η. CORDOFANA: calyx large, cupulate, longer than the tube of the corolla; its lobes united above the middle, somewhat carinate; scales as in var. *australis*; stamens and style

shorter than in any other form of the species.—Fezogl, Cordofan, Figari! in Hb. Mus. Florent.

40. C. CHLOROCARPA, Engelm.! in Gray Man. ed. 1, p. 350; ed. 2, p. 337; *C. Polygonorum*, Engelm.! in Sillim. Journ. 43, p. 342, t. 6, f. 26–29;* DC. Prod. IX. 461, not Cesati.—Along ponds and wet places, mostly on different species of *Polygonum*, and also on other plants of these localities; St. Louis, Missouri, Drummond! Lindheimer! Engelmann! Illinois, Engelmann! Wisconsin, Lapham! Indian country west of Arkansas, Bigelow! eastward thus far only in Delaware, Tatnall!—Closely allied to the last species, especially to var. *breviflora;* the principal difference lies in the triangular, acute lobes of calyx and corolla. Flowers usually 4-parted, about one line long; scales small, bilobed or oftener consisting of small lateral teeth; in a specimen from Delaware they are very incomplete, or sometimes almost wanting; large ovary filling the shallow tube of the corolla; capsule comparatively large, thin, membranaceous, of a greenish yellow color, whence the name, which I substituted for my former one, referring to the plants on which it is often found; this color of the capsule distinguishes it already at a distance from other species growing in the same region. Seeds 0.8 line long, oval, compressed, scarcely angled; transverse hilum rather shorter than in the last species.

41. C. ARVENSIS, Beyrich! in sched.; Engelm.! in Gray Man. ed. 2, p. 336.—The different varieties of this species are characterized by smaller flowers (often less than 1 line long) in more compound clusters, which approach in their form to those of the next species; lobes of calyx very obtuse; lobes of corolla almost always longer than the tube, acute or usually accuminate, reflexed and with the point inflexed; anthers broadly oval or rounded; scales large, deeply laciniate-fimbriate, often exceeding the tube; styles rather slender, as long as ovary, or longer; seeds 0.5–0.7 line long, oval or rounded, compressed, with a rather short, linear, often oblique hilum. The differences in the shape, size and texture of the calyx constitute the following varieties.

Var. *a.* PENTAGONA; *C. pentagona*, Engelm.! in Sill. Jour. 43, p. 340, t. 6, f. 22-24; DC. Prod. IX. 461; *C. arvensis*, Beyrich! in Hb.; *C. globularis*, Nutt.! in Hb.—Calyx thin and shining; lobes orbicular, as long or longer than the shallow tube of the corolla, forming, where they join, 5 projecting angles.—Dry barren soil or old fields on different *Compositæ*

* The article on American *Cuscutæ*, which originally appeared in Silliman's Journal, was reprinted in Hooker's London Journal of Botany, II. 184 t. 3, 1843, and in Schultz's Archives de Flore, 1855, p. 65.

or other plants, sometimes also on shrubs; from Virginia, Rugel! Sullivant & Gray! to the Carolinas, Schweinitz! Bosc! Beyrich! Curtis! Ravenel! and to Florida, Rugel! nro. 400, a. & b.

The western form, with shorter lobes of the less distinctly angled calyx was formerly distinguished by me as var. *microcalyx*.—In open woods, on dry soil, on *Solidago*, *Aster*, *Ceanothus*, etc., Illinois, Geyer! Missouri, Trécul! Riehl! Nebraska, Hayden! Indian country west of Arkansas, Bigelow! The latter has often as large a calyx as the eastern form.

Var. β. VERRUCOSA; *C. verrucosa*, Engelm.! l. c. p. 341, t. 6, f. 25; DC. Prod. IX. 461.—Calyx shorter than the campanulate tube, fleshy and glandular-verrucose.—On dry prairies, often on *Petalostemon*, but also on other prairie plants: Texas, Drummond! III. 247; Lindheimer! 127; Northern Mexico, Berlandier! 2457, to San Luis Potosi, the same! and Parras, Gregg!—Lindheimer's nro. 473 is an intermediate form between this and var. *pentagona*, mixed with a few specimens of the following.

Var. γ. PUBESCENS: pedicels and all parts of the flower or only the ovary and the capsule papillose-pubescent.—Western Texas, Lindheimer! Wright! 1635 (574.)—Wright's 519 and 523 (coll. 1849) are a transition form between this and the last variety, having the calyx of *verrucosa* and the ovary and capsule of *pubescens*.

Var. δ. CALYCINA: inflorescence often more compact; flowers rather larger; hemispherical calyx not angled, lobes rounded or oval, usually longer than the tube; lobes of corolla broader and shorter than in the other forms, and often not longer than the tube.—Texas, Lindheimer! 126, (a form from wet prairies, with smaller flowers); the same! 664; Wright! both on *Dianthera*, in or along water courses; Martinique, Mad. Richard! 114 in Herb. Mus. Flor.; Herb. Fauché! (now in Hb. Boissier); Saskatchawan, Drummond! *C. Americana?* Hook. Fl. N. A.; Oregon, Geyer! 674.

Specimens from Brazil Eschscholtz! in Hb. Ledebour; Gardner! 6068 in part, (*C. decora* has also been distributed under this number) differ somewhat from this variety by stouter and, in fruit, subulate styles; Gardner's specimens have also a smaller calyx.

** Flowers arranged in loose compound cymes; styles usually slender, as long or longer than ovary; withered corolla remaining at base of capsule or enveloping it.

42. C. TRICHOSTYLA, n. sp.: caule filiformi; bracteis ovatis obtusis; floribus breviter pedicellatis in cymulas ramosas subglobosas congestis; calycis cupulati fere ad basin divisi

lobis ovatis orbiculatisve obtusis basi imbricatis tubum corollæ campanulatum æquantibus seu superantibus; laciniis ovatis obtusis tubo æquilongis demum patulis reflexisve; antheris ovatis filamenta subulata brevia æquantibus; squamis late ovatis fimbriatis incurvis; stylis capillaribus ovario depresso multo longioribus e tubo vix exsertis.

Panama, Tweedie! Santarem, Brazil, on *Hyptis*, Spruce! 854, both in Hb. Hooker.—None of the specimens examined being in fruit, the true position of this species must remain doubtful. The large imbricate calyx, the slender styles, and especially the branching inflorescence, distinguish it from *C. obtusiflora;* the inflorescence the shape of the ovary and of the styles from *C. Gronovii* and *C. racemosa.*—Flowers $1\frac{3}{4}$–2 lines long, "white, with a strong odor of hawthorn," Spruce; exterior lobes of the calyx in the Panama specimen towards the tip verrucose-cristate; in the other smooth, thin and shining; scales in the former longer than the tube, in the other broader and shorter.

43. C. GYMNOCARPA, n. sp.: caule filiformi; floribus breviter pedicellatis umbellato-glomeratis; calycis lobis ovatis seu orbiculatis obtusissimis nitidis tubum corollæ æquantibus; laciniis triangulatis acutis erectis seu demum patentibus tubo æquilongis; antheris ovato-orbiculatis filamentum breve subulatum æquantibus; squamis tenuissimis late ovatis fimbriatis faucem attingentibus; stylis capillaribus ovarium depressum æquantibus supra capsulam globoso-depressam e corolla ad basin marcescente longe exsertam divaricatis patentibus recurvisve; seminibus oblique ovatis tumidis tenuissime sub lente reticulatis.—*C. Sandwicensis*, var. *Mimosæ*, Hook. fil. in Lin. Trans. XX. 205.

James Island of the Gallopagos group, in immense abundance on Mimosa bushes, Chs. Darwin! in Hb. Hooker.—Flowers about 1 line long, of a very thin texture; capsule $1\frac{1}{4}$–$1\frac{1}{2}$ lines in diameter, with a very small intrastylar aperture; seeds in the only specimen extant light yellowish brown, 0.6 line long, plump, nearly smooth, with a short, oblong-linear, usually perpendicular, hilum.—Much closer to *C. arvensis* than to *C. Sandwichiana;* distinguished from both by the short, broad and very acute lobes of the corolla, and by the very slender, at last nearly horizontal, styles; from the latter, also, by the presence of scales and by the naked capsule.

44. C. SANDWICHIANA, Choisy! Cusc. 184, t. 5, f. 4; DC. Prod. IX. 458.—Sandwich Islands; apparently the only species growing there; mostly on shrubs; Menzies! Eschscholtz! Gaudichaud! Matthews! Stewart! Maximowitsch! 57; Remy! 424.—Inflorescence a compound loosely flowered cyme; flowers pedicelled, 1–$1\frac{1}{2}$ lines long, "pallide ochracei" Maxim., of thin, membranaceous texture; only in Menzies' specimen

in Hb. Banks I find all the parts of the flower dotted with glands; lobes of calyx ovate, acutish; lobes of corolla acute and inflexed at tip or sometimes obtusish, often reflexed, but at last commonly appressed to the top of the capsule, which for its greater part is enveloped by the tube; anthers oval; no trace of scales; capsule 1¾–2 lines in diameter, with a small, almost circular, intrastylar aperture; styles stouter than in the last species, somewhat divaricate on capsule; seeds unusually large, 0.8–1.0 line long, verrucose-reticulate, triangular-ovate, somewhat oblique but not rostrate, with a short linear-oblong perpendicular hilum on the comparatively small regularly circular umbilicus.

45. C. ACUTA, n. sp.: caulibus subcapillaceis; cymis compositis laxifloris umbellulas mentientibus; pedicellis flore brevioribus bracteis ovatis acutis suffultis; calycis late campanulati membranacei lobis triangulatis acutis seu cuspidatis tubum corollæ campanulatum superantibus; laciniis lanceolatis acutatis tubo longioribus erectis seu subpatentibus; antheris oblongo-linearibus filamento subulato fere brevioribus; squamis ovato-spatulatis longe adnatis faucem attingentibus versus apicem crispato-fimbriatis; stylis capillaceis ovarium obovatum seu globosum æquantibus; capsula tenuissima corollæ rudimentis ad basin persistentibus indusiata apice libera stylis e basi lata subulatis paulo divergentibus coronata; seminibus 2–4 lenticularibus rugoso-reticulatis.

Chatham Island of the Gallopagos group; mostly on *Leguminosæ*, common on a low annual *Crotalaria*, but also on trees, such as *Parkinsonia* and *Mimosæ*, hanging down in massy festoons, Andersson!—Closely allied with both other Pacific species just described, distinguished from them by the very acute lobes of calyx and corolla and by the subulate styles; moreover from *C. Sandwichiana* by the presence of scales, and from *C. gymnocarpa* by the covered capsule and the direction of the styles; from *C. acutiloba* of the mountains of the neighboring coast and from *C. umbellata* it differs by the inflorescence, by the baccate capsule, etc.—Flowers 1–1¼ lines long; scales adnate nearly to the apex, crenulate on the sides, fringed only at tip; capsule about 1 line in diameter; intrastylar aperture large, forming a transverse slit; seeds only 0.5 line long, dark brown in the specimen before me; (perhaps not perfectly ripe) and strongly reticulate; hilum short, oblong-linear, perpendicular or oblique.—The specimens examined by me were all on a low *Crotolaria.*

*** Flowers arranged in branching paniculate cymes; styles slender, as long or longer than ovary; withered corolla surrounding the capsule or covering its top.

46. C. TENUIFLORA, Engelm.! in Gray, Man. ed. 1, p. 350;

ed. 2. p. 336; *C. Cephalanthi*, Engelm.! in Sill. Jour., XLIII. 336, t. 6, f. 1–6.—Wet places, often on *Cephalanthus*, *Salix*, *Cornus* and other shrubs, but also on *Vernonia*, *Aster*, and other herbaceous plants; Missouri and Illinois, Engelmann! Geyer! Upper Missouri country, Hayden! New Mexico, Wright! 1629 (124); Arizona, the same! 1626 (578).—In young plants just beginning to flower the cymose-paniculate inflorescence is very distinct; the terminal flowers of the main branches of the inflorescence opening first, and lateral clusters of smaller and ever smaller buds appearing lower down on the peduncles; a little later the fruits occupy the ends of the branches, while more and more flowers and buds are developed on lateral peduncles and pedicels, till at length the whole becomes one large and intricate, and often quite compact, cluster. Short pedicels gradually swelling into the base of the turbinate calyx; flowers ordinarily 1 line or less in length, mostly 4-parted, later flowers often only 3-parted; tube of the corolla slender, much longer than the calyx, and larger than the short ovate obtuse laciniæ; scales ovate or spatulate, shorter than the tube; capillary styles as long as the depressed ovary; capsule globose, 1–1¼ lines in diameter, bearing the withered corolla on top, often with only 1 or 2 seeds; seeds 0.6–0.7 line long, oval, oblique, carinate on the inside, with a short linear-oblong usually perpendicular hilum.—The western forms collected by Mr. Wight differ from those of the Missouri and Mississippi valleys only by having larger flowers (1.2–1.4 lines long), larger, more depressed, mostly 4-seeded capsules (1½–2 lines in diameter) and larger (0.8 line long) flatter seeds.

Choisy in DC. Prod. IX. 458, wrongly gives this very distinct species as a synonym of *C. compacta*, with which it has scarcely any thing in common but the hooded capsule; from small flowered forms of *C. Gronovii* it differs by the position of the dead corolla and by the structure of the ovary and capsule.

47. C. Californica, Choisy! Cusc. 183; DC. Prod. IX., 457; Hook & Arn.! Bot. Beechy, 364.—Both authors described this plant from Douglas' specimens under the same name and in the same year, (1841); Nuttall, in the Hb. Acad. Philad., had named it *C. acuminata*.—Flowers on slender pedicels, loosely paniculate; calyx small, turbinate with acute triangular, lanceolate or acuminate and sometimes recurved lobes; laciniæ very slender, lanceolate-linear, acute or acuminate, erect or spreading, in fruit mostly erect or connivent; scales wanting, or indicated by a membranaceous inverted arch, with a smooth or crenulate margin connecting the adnate parts of the filaments near the base of the corolla; in a doubtful variety the scales are fully developed; styles

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The different specimens examined vary considerably in the shape and length of the calyx, the proportion of the laciniæ to the tube, the length of the filaments, the indication of scales, the length of the styles and even the shape of the ovary.

Var. α. BREVIFLORA: flowers scarcely more than 1 line long, on short pedicels; laciniæ rather longer than tube; anthers, filaments and styles short; seeds several.—Monterey in fields, Hartweg! 1863.

Var. β. GRACILIFLORA: flowers slender, 1½–2½ lines long; calyx often shorter than tube of corolla; laciniæ as long as the tube, very narrow; filaments often short, or as long or longer than the linear-oblong anthers, styles as long or much longer than ovary.—California, Douglas! Fremont! 506; Bigelow!

Var. γ. LONGILOBA: Flowers 2–2½ lines long; calyx usually equal to the tube, rarely shorter, sometimes longer; laciniæ slender, sometimes twice the length of the tube; subulate filaments as long or longer than the oblong-linear anthers; styles very long and slender.—California, principally, as it appears, on the coast of the southern parts of the State and commonly on some species of *Eriogonum:* Sta. Barbara, Nuttall! San Diego, Thurber! 570 & 633; Newberry!

Var. δ. APICULATA: corolla somewhat granulate, ovary and 1-seeded capsule conic, apiculate; otherwise very similar to the last.—On the Colorado, Bigelow! in February.

Var. ε. ? SQUAMIGERA: flowers 2–2½ lines long, on pedicels shorter than the flower, or even the calyx, in rather crowded subglobose clusters; lobes of calyx lanceolate, acuminate, as long as the open, funnel-shaped tube of the corolla; laciniæ lanceolate, as long as the tube, at last spreading; anthers oblong-linear, cordate at base, on very short filaments; scales spatulate, fringed, shorter than the tube, incurved; styles as long as the very acute ovarium; capsule apiculate, 1-seeded, lower half enveloped by the tube of the corolla.—The more densely clustered flowers, the presence of scales and the acute ovarium would seem to specifically distinguish this form, but the last mentioned variety appears to unite it with the common form; perhaps it ought to be classed with the next species.—Saline soil on the Rio Virgen, Utah, on *Suæda*, J. Remy! in Hb. Mus. Paris.

§ 2. Oxycarpeæ.

Flowers subsessile, or pedicelled; sepals united; ovary and capsule thickened towards the apex, usually more or less conic.

ed. 2. p. 336; *C. Cephalanthi*, Engelm.! in Sill. Jour., XLIII. 336, t. 6, f. 1–6.—Wet places, often on *Cephalanthus*, *Salix*, *Cornus* and other shrubs, but also on *Vernonia*, *Aster*, and other herbaceous plants; Missouri and Illinois, Engelmann! Geyer! Upper Missouri country, Hayden! New Mexico, Wright! 1629 (124); Arizona, the same! 1626 (578).—In young plants just beginning to flower the cymose-paniculate inflorescence is very distinct; the terminal flowers of the main branches of the inflorescence opening first, and lateral clusters of smaller and ever smaller buds appearing lower down on the peduncles; a little later the fruits occupy the ends of the branches, while more and more flowers and buds are developed on lateral peduncles and pedicels, till at length the whole becomes one large and intricate, and often quite compact, cluster. Short pedicels gradually swelling into the base of the turbinate calyx; flowers ordinarily 1 line or less in length, mostly 4-parted, later flowers often only 3-parted; tube of the corolla slender, much longer than the calyx, and larger than the short ovate obtuse laciniæ; scales ovate or spatulate, shorter than the tube; capillary styles as long as the depressed ovary; capsule globose, 1–1¼ lines in diameter, bearing the withered corolla on top, often with only 1 or 2 seeds; seeds 0.6–0.7 line long, oval, oblique, carinate on the inside, with a short linear-oblong usually perpendicular hilum.—The western forms collected by Mr. Wight differ from those of the Missouri and Mississippi valleys only by having larger flowers (1.2–1.4 lines long), larger, more depressed, mostly 4-seeded capsules (1½–2 lines in diameter) and larger (0.8 line long) flatter seeds.

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§ 2. Oxycarpeæ.

Flowers subsessile, or pedicelled; sepals united; ovary and capsule thickened towards the apex, usually more or less conic.

* Flowers subsessile, crowded in rather dense, small or large and compound glomerules; withered corolla enveloping or covering the 1-2-seeded capsule.

48. C. SUBINCLUSA, Durand & Hilgard! in Jour. Ac. Phil. III. p. 42, and in Pacif. R.R. Rep. V. 3, p. 11.—This fine and large flowered species resembles different forms of *C. corymbosa* and *C. odontolepis* so much, that I felt considerably inclined to unite all of them as varieties of one and the same species; but then the dehiscence or nondehiscence of the capsule would have to be considered as a character of not even specific importance; there are, however, also other differences, so that these species must be viewed as representing different types under a similar external form.—Flowers 2–3 lines long, on very short pedicels or almost sessile, paniculate-glomerate, at last forming large and rather dense clusters; cylindrical tube of corolla longer than the deeply divided calyx; lobes fleshy, ovate lanceolate, acutish, imbricate; laciniæ ovate, acute, more or less crenulate, shorter than the tube, erect or patulous; anthers oblong or ovate, cordate, usually longer than the filaments, or even subsessile; scales scarcely reaching above the middle of the tube, spatulate-oblong, deeply fringed; styles slender, much longer than the 2-pointed ovary, at first scarcely exsert; capsule oval, 1-2-seeded, its upper part capped by the withered corolla; seeds 0.7–0.9 line in diameter, rough, oval or subglobose, oblique or almost hooked, with a very small oblong hilum.

On the Tejon Pass in the southern part of California, on *Salix* and *Artemisia*, Heermann! in the same region on *Cratægus*, Le Conte! Sierra Nevada, above Placerville, Remy! Saline marshes on Mare Island, Bay of San Francisco, on *Grindelia*, Wright!—It is remarkable, but in this genus not unusual, that specimens from the high mountains are absolutely identical with those from the salt marshes of the coast; the only difference I can discover consists in the flower being a little larger, the filaments longer and the anther shorter.

Var. β. ABBREVIATA: lobes of calyx more membranaceous, less deeply divided, scarcely imbricate, rather longer than the short funnel-shaped tube of the corolla; laciniæ as long as tube; styles as long as the conic ovary, shorter than the oval capsule which is entirely enveloped by the corolla.—Mare Island in San Francisco Bay, on *Arthrocnemon*, Wright!

49. C. MICRANTHA, Choisy! Cusc. 175, t. 1, f. 3, DC. Prod. IX., 453; Gay! Fl. Chil. IV. 446.—A small flowered and low species, perhaps the lowest one in South America, peculiar to Chili: Coquimbo, on the shore of the Ocean, always on *Frankenia*, Cl. Gay! 538; Concon, on *Plantago*, *Trifolium*, etc., Pœppig! 89 under the name of *C. Popayanensis*;

St. Jago, Dr. Philippi! Besser!—Flowers about one line long on short pedicels or almost sessile, in small compact clusters; lobes of calyx and corolla broadly triangular, acute, the latter often somewhat crenulate; scales usually small, ovate or spatulate, attached to the middle of the tube and scarcely reaching to the throat; styles capillary, usually much shorter than the conic ovary; stigmas rather small but very distinctly capitate, so that it is difficult to understand how Choisy could place this species among those with filiform stigmas; even his own figure, though not quite correct, does not bear him out.—Capsule oval, 1-seeded, enveloped in the corolla, with top naked; seed 0.6 line long, compressed obovate, rostrate, rough, with a very small hilum reduced to almost a point. This is Choisy's original plant, from Coquimbo; all the other specimens cited above belong to

Var. β. LATIFLORA: flowers rather larger, 1¼–1½ lines long, petals spreading, scales often larger, styles longer; fruit not seen. Some of Pœppig's plants approach the original specimens by their small flowers and crenulate laciniæ.

** Flowers pedicelled, disposed in rather loose paniculate cymes, which often at last become crowded; withered corolla usually enveloping the capsule or covering its top, in the three last species investing only its base.

† Lobes of corolla acute or rarely obtuse, inflexed or corniculate at the apex.

50. C. DECORA, Choisy, under the name of *indecora*; Choisy saw only a very poor blackened specimen, such as Berlandier was in the habit of making, of the small flowered variety; but it so happens that this is one of the prettiest species, so much so, that Scheele has named it *pulcherrima*; I therefore feel justified in the liberty I take with Choisy's name in lopping off its negative *in*.—This is a wide spread and quite variable species, extending from the United States to Brazil, always readily recognized by the structure of the fleshy white flowers, which consist of large convex cells, which make the surface appear rough and the margin crenulate; these cells are on the surface sometimes elongated into oval or cylindric papillæ; inflorescence loosely paniculate or in some forms at last more compact; lobes of calyx ovate or lanceolate, acute, of different lengths; laciniæ ovate-lanceolate, inflexed at the acute point, erect or spreading, not recurved; scales large, broadly oval; styles usually stout and very unequal; about as long as the conic ovary; capsule enveloped by the corolla; seeds usually several, 0.6–0.9 line long, obliquely ovate, rostrate, rough, with a very short, oblong, transverse hilum. The following varieties may be distinguished.

Var. *α.* INDECORA; *C. indecora*, Choisy! Cusc. 182, t. 3, f. 3; DC. Prod. IX. 457; *C. neuropetala*, *β. minor*, Engelm.! in Boston Journ. N. Hist. V. 223; flowers 1–1¼ lines long, on long pedicels, loosely panicled, with very short calyx.—On the Rio Grande, Berlandier! 865 & 2285; Texas, Lindheimer! 123, (in some of the distributed collections the numbers 123 and 124, both forms of this species, are transposed).—A papillose-hispid form of this variety is *C. verrucosa*, *α. hispidula* Englm.! Sill. Jour. 43, p. 341; *C. hispidula*, Engelm.! ib. 45, p. 75; DC. Prod. IX. 461; Texas, Berlandier! 956 & 2386; Drummond! 248; Lindheimer! 474; Wright! Some of these specimens by their larger flowers approach the next form.

Var. *β.* PULCHERRIMA; *C. neuropetala*, Engelm.! l. c. 45, p. 75; DC. Prod. IX. 461; *C. pulcherrima*, Scheele! in Linnæa 21, p. 750; smooth or rarely slightly papillose; inflorescence loose or sometimes more compact; flowers variable in size, 1¼–1¾ lines long, usually broadly campanulate; calyx as long or longer than tube; styles usually as long as ovary, rarely much longer; anthers and stigmas yellow or often purple. A form with very large and broad flowers is *C. neuropetala*, *γ littoralis*, Engelm. Boston Journ. l. c.—On wet and dry prairies, from the seacoast to the mountains, on different shrubs, also on herbaceous *Compositæ*, *Leguminosæ*, etc.: south-western Illinois, Engelmann! Indian country west of Arkansas, Fremont! 2d Exp. 485; Bigelow! Texas, Lindheimer! 124 (a very large flowered form) 474, 475; and westward, Wright! coll. 1849, nros. 520, 521, 524, 525; coll. 1851–'52, nros. 1630, 1633, 1634, 1637, 1638; Sonora, Wright! 1622; Northern Mexico, Gregg! 78 and 888; Florida, Chapman! St. Marks, Rugel! 1000 & 1001; Cuba, Hb. Vind.! Jamaica, McFaddin! Bancroft! a small flowered, short styled form; Cumming! 95; Alexander! Brazil, Salzmann! in Hb. Buchinger; Gardner! 5036, a form with very long styles, and 6068 in part (*C. arvensis* var. has been distributed under the same number.)

Var. *γ.* SUBNUDA: lower half of capsule enveloped by the tough remains of the corolla, upper part naked; short styles divaricate.—"Common on the overflowed islands of the Parana," Brazil, Tweedie! in Hb. Hooker.

Var. *δ.* INTEGRIUSCULA: calyx shorter than the deeply campanulate tube of the corolla; laciniæ erect; scales triangular, acutish, thin, almost entire; styles capillary, shorter than ovary.—Mendoza, on *Ephedra*, Gillies!

51. C. INFLEXA; *C. Coryli*, Engelm.! in Sill. Journ. 43, p. 337; *C. umbrosa*, Beyrich! in Hb. reg. Berol. in part, not Hooker; Engelm.! in Gray Man. ed. 1, 351; ed. 2, 336; *C. parviflora*, Nutt.! in Hb.; *C. congesta*, Beyr.! in Hb.; *C.*

compacta, var. *crenulata*, Choisy in DC. Prod. IX. 459.—In open woods or dry prairies, usually on shrubs, *Corylus*, *Ceanothus*, *Symphoricarpus*, *Rhus*, *Salix* and even on *Carya*, but also on *Helianthus*, *Solidago* and other Compositæ, etc. Virginia, Beyrich! Gray & Sullivant! Georgia, Beyrich! Illinois and Missouri, Engelmann! Riehl! Kansas, Fendler! 658; region west of Arkansas, Bigelow! on the Upper Missouri and Yellowstone rivers, Hayden!—Flowers 1 line long, of similar structure as the last; distinguished by the deeper, subcylindric, mostly 4-parted corolla, which at last covers only the top of the capsule, the erect, inflexed laciniæ and the minute scales, reduced to lateral teeth; styles of different lengths, divaricate on capsule; seeds ovate, oblique, thick, 0.6–0.7 line long, with a small, oblong, oblique or transverse hilum.

52. C. APPENDICULATA, n. sp.: caulibus capillaceis; cymis fasciculato-paniculatis laxifloris; calycis brevissimi basi glanduloso-appendiculati lobis ovatis acutis tubum profunde campanulatum vel subcylindricum dimidium vix æquantibus; laciniis ovato-lanceolatis demum reflexis apice acuto incurvis tubo æquilongis; antheris ovato-orbiculatis cordatis filamento longioribus; squamis obovatis crispato-fimbriatis faucem æquantibus incurvis; stylis tenuibus ovario acuto subæqualibus; capsula globosa apiculata sub-1-sperma exserta supra medium nuda, foramine intrastylari magno; seminibus ovato-subglobosis obliquis.

Cape of Good Hope, on *Erica* and other shrubs: Zwellendam, "on dry hills throughout the whole district," Kraus! nro. 1816, under the name of *C. Africana;* Teufelsberg, in Hb. Fischer! now Hb. H. B. Petropol.—The only South African species belonging to this section; distinguished by the very small (scarcely ¼ line long) appendiculate calyx, etc.; flowers 1–1¼ lines long; seeds 0.6 line long.

53. C. STENOLEPIS, n. sp.: caulibus capillaceis; cymis paniculatis laxis paucifloris; pedicellis elongatis bractea ovata suffultis; calycis turbinati glandulosi lobis ovatis obtusis tubo corollæ subcylindrico brevioribus; laciniis tubo brevioribus lanceolatis reflexis apice acutiusculo incurvis; staminibus brevissimis, anthera ovata filamento subulato æquilonga; squamis angustissimis parce fimbriatis faucem vix attingentibus incurvis; stylis ovarium conicum bicuspe subæquantibus demum exsertis; capsula globosa apiculata sub-1-sperma apice corolla calyptræformi tecta; seminibus subglobosis asperatis.

Andes of Quito, Fr. Hall! in Hb. reg. Berol.; J. P. Couthouy! on a *Dalea* "on the banks of the Machange, 9,500 feet high."—A very distinct species covering low shrubs with intricate masses of their hair-like stems, with scattered loosely flowered panicles; whole plant filled with a reddish yellow juice; flowers scarcely more than 1 line long; scales very narrow, linear, irregularly and sparsely laciniate-fimbriate towards the tip; seeds 0.7 line long.

54. C. CORNICULATA, n. sp.: caulibus filiformibus crassiusculis; cymis bracteosis laxis paniculatis seu magis compactis subglobosis; bracteis membranaceis ovatis obtusis; floribus pedicellatis; calycis campanulati ultra medium fissi lobis ovatis carinatis basi imbricatis obtusis seu cuspide nodoso-incrassato obtusato apiculatis subinde patulis recurvisve corollæ tubum æquantibus seu superantibus; laciniis tubo æquilongis ovato-lanceolatis demum patulis reflexisve apice nodigero seu cucullato corniculatis inflexis; antheris oblongis filamenta subulata æquantibus; squamis late ovatis fimbriato-fissis tubum excedentibus incurvis; stylis ovarium pyriforme æquantibus, stigmatibus magnis pileatis; capsula corolla marcescente indusiata apice nuda, orificio intrastylari magno; seminibus oblique ovatis intus carinatis.

Var. α. RACEMULOSA: floribus laxe paniculato-cymosis; calycis lobis apice nodoso acutiusculis.—Southern Brazil, Sellow! 2489 and 3621 in Hb. reg. Berol.

Var. β. SPHÆROCYMA: floribus globoso-cymosis; calycis lobis acutiusculis seu obtusis.—Brazil, Prov. Goyaz, on the campos near the Buixas, Weddell! Venezuela, on the Rio Meta, Karsten!

This is the first of a series of intricate, mostly Brazilian species, which includes nros. 54–58, and which will not be entirely cleared up until carefully studied in their native homes. The inflexed-pointed laciniæ and the naked capsule with the large intrastylar orifice seem to distinguish it sufficiently from *C. racemosa*. Whether both forms described above, which seem to differ so materially in their inflorescence, really do belong together, must be decided after a fuller study of this whole group; Weddell's specimen seems to connect them.—Flowers 1–1¾ lines long; cymes of one 5–8 lines, glomerules of the other 4–5 lines in diameter; seeds of the largest flowered specimen 0.6–0.7 line long, obliquely ovate, with a very short linear-oblong transverse hilum.

55. C. RACEMOSA, Martius; spread in several forms over a great part of South America, just like *C. Gronovii* over North America, and *C. planiflora* over Asia and the Mediterranean regions; it has been introduced with agricultural seeds into Europe, where it has given rise to many discussions, and has, to some extent, stimulated botanists to a further examination of this genus.—All the forms of this species are characterized by the loose racemose-paniculate inflorescense; calyx usually shorter than the deeply campanu-

late gradually widening tube; laciniæ commonly short, spreading or reflexed with inflexed points; scales large; ovarium ovate or obovate, the upper part being compact; styles stout with large, depressed, almost peltate stigmas; capsule commonly enveloped by the corolla, with 2–4 light brown, oval, obliquely truncate or rostrate seeds, 0.6–0.7 line in length; hilum short, linear, perpendicular or transverse, often with radiating lines on the umbilicus. I distinguish the following forms:

Var. α. BRASILIANA; *C. racemosa;* Martius! itin. I. 286; Choisy! Cusc. 181, t. 3, f. 1; DC. Prod. IX. 456; flowers with few or scarcely any glands, of a rather membranaceous texture and pale color, with very short and obtuse lobes of calyx and obtusish lobes of corolla; flowers usually 1½ lines long.—Common about Rio and generally in Brazil, on shrubs and herbaceous plants; Martius! 941; Booz! Gaudichaud! Graham! Pohl! 5100, in part; Riedel, 695.

Var. β. MINIATA: *C. miniata*, Martius! l. c.; var. *minuta*, Choisy! l. c.; flowers of a thicker texture, reddish, more or less glandulous.—Brazil, Martius! 1292; Ackermann! Mikan! Langsdorff! Pohl! 5100 in part; Vauthier! 252; Lund! 737.

Var. γ. CHILIANA; *C. Chilensis*, Bertero! in sched., not Ker; *C. suaveolens*, Seringe, Ann. Sc. phys. nat. Lyon, 1840; Cl. Gay! Fl. chil. IV. 448; DesM. Et. 66 (under *Cassutha*, and confounded with *C. obtusiflora*, var. *breviflora*); *C. corymbosa*, Choisy! Cusc. 180; DC. Prod. IX. 456, not Ruiz & Pav.; *C. Hassiaca*, Pfeiffer! Bot. Zeit. 1843, p. 705; *Eng. migrans*, Pf. ib, 1845, p. 674; *C. diaphana*, Wend. Fl. hass. 364; *C. Popayanensis*, Pœppig! in Hb. Vind. not H. B. K.—Flowers larger, 1½–2 lines long, more membranaceous; lobes of corolla with acute inflexed points; scales as long as, or often shorter, than the tube.—Chili, Bertero! 205 in Hb. DC., 940 & 201 in Hb. Shuttleworth (nro. 940 in Hb. DC. is *C. Chilensis*); Pœppig! Cl. Gay! 449; about twenty years ago it was introduced into Europe, but is apparently now lost; on *Medicago sativa*, sometimes, in wet seasons, destroying whole fields; also parasitic on many other plants growing about such fields; it has been observed in France, Piedmont, Switzerland, Germany and Holland.

Var. δ. CALYCINA; *C. suaveolens*, Lechler! in sched.; flowers as large as in the last, often glandulous, with longer and obtusish lobes of calyx and corolla, both as long as the short and wide tube; dead corolla covering the capsule.—Brazil, Sellow! in Hb. reg. Berol., Weddell! Riedel! Valdivia, Lechler! 479.

Var. ε. NUDA; *C. citricola*, Schlecht. Linn. XXII. 808? Lobes of glandular calyx ovate, nearly as long as the tube of the corolla; laciniæ of same length, reflexed, at the obtusish apex inflexed; styles as long as the conic ovary, at last divaricate; lower part of the depressed somewhat glandulous capsule covered by the corolla, upper half free.—Brazil, near Rio, Sellow! 4.99 B.; southern Brazil, the same! in Hb. reg. Berol.; Riedel! 990 in Hb. H. B. Petrop.; Island of Sta. Catarina, southern Brazil, on *Citrus*, Pabst ex Schlechtend.

56. C. PARVIFLORA, n. sp.: caulibus capillaceo-filiformibus intricatis; cymis fasciculato-paniculatis laxis paucifloris; pedicellis flore minuto late campanulato longioribus; calycis turbinati lobis ovatis obtusiusculis tubum corollæ æquantibus; laciniis ovatis seu lanceolatis patulis apice obtusiusculo inflexis; staminibus brevibus, antheris ovatis filamenta æquantibus; squamis ovatis laciniato-fimbriatis conniventibus; stylis ovario obovato æquilongis.—*C. micrantha*, Martius! in Hb., not Choisy.

Var. *β*. ELONGATA: pedicellis elongatis clavatis; floribus minoribus; laciniis acutis tubo subduplo longioribus demum reflexis; filamentis subulatis gracilibus lacinias æquantibus.

Brazil, Minas Geraes, on *Trembleya*, Ackermann! Villa Rica, on some other shrub; Pohl! 5726; Var. *β*. Goyaz, Weddell! 2125.—Flowers only $\frac{1}{2}$–$\frac{3}{4}$ line long, smaller than in any other species, with the exception perhaps of the smallest forms of *C. Palæstina;* of a deep red color when dry; limb of corolla spreading but not reflexed; fruit unknown. In var. *β*. the pedicels are 2 or 3 times as long as the "whitish" flowers; laciniæ and especially filaments much longer and more slender.

†† Lobes of corolla obtuse, not incurved.

57. C. DENSIFLORA, Hooker, fil.! in Fl. N. Zeal. I. 186, not Soyer-Will.—At Port Underwood, on the middle island of New Zealand, on some *Apocynea*, Dr. Lyall!—Perhaps too near *C. racemosa*, but apparently distinguished by the much finer capillaceous stems, the very short cupulate calyx, the short, ovate, obtuse spreading but not reflexed nor inflexed lobes of the corolla, which are only about one-third as long as the deeply campanulate tube, and by the solitary globose seeds of a brown red color, with a short linear transverse hilum on the radiately marked umbilicus.—Flower 1$\frac{3}{4}$–2 lines long, dotted with yellow glands, which Dr. Hooker describes as oil-canals; pistils the same as in *C. racemosa;* dead corolla covering and enveloping the capsule.

58. C. MICROSTYLA, n. sp.: caulibus filiformibus floribusque glandulosis; cymulis laxis paucifloris; calycis lobis triangulato-ovatis obtusis corollæ tubo profunde campanulato bre-

cymules, which form a compound spike or raceme; withered corolla remaining, hoodlike, on the very top of the large capsule.

Parasitic mostly on ligneous plants. Of the 8 species of this section, 5 belong to the continent of Asia, 2 of which extend into Europe; 1 is peculiar to the island of Timor, 1 to South Africa, and 1 to Texas.

68. C. EXALTATA, n. sp.: caule funiculari; floribus breviter pedicellatis seu sessilibus spicato-paniculatis; calycis globosi lobis fere disjunctis orbiculatis concavis imbricatis medio verrucosis corollæ tubum cylindricum æquantibus; laciniis orbiculatis imbricatis tubo multo brevioribus erectis seu erecto-patulis; antheris cordato-orbiculatis ad faucem sessilibus; squamis bipartitis dentatis tubo multo brevioribus; stylo apice bifido ovario ovato-globoso æquilongo, stigmatibus subglobosis.

Parasitic on *Diospyros Mexicana*, *Ulmus crassifolia*, *Quercus virens*, *Juglans*, *Rhus*, etc., 10–20 feet high, in western Texas, on the Guadaloupe and Cibolo, Lindheimer! 472; on the Colorado and Blanco, Wright! on the Leona and at the mouth of the Pecos, Bigelow! on the Rio Grande, Schott!—Stems 1–2 lines in diameter; compound panicles several inches in length; flowers 2 lines long, small tube hidden in the large calyx; anthers closely sessile; scales reduced to two dentate wings on the sides of the very distinct attached filaments, united at base; upper fourth of the thick style divided; stigmas depressed, thicker than the ends of the style; capsule 3½–5 lines long; seeds 1½–1¾ lines long, somewhat triangular, very slightly rostrate. The large embryo is coiled up in 2–3 rounds; on the upper (thinner) end 3–4 alternate scales may be distinguished. This is the only species of this section, where the styles are not completely united. I formerly distributed it under the the name of *C. gamostyla.*

69. C. CASSYTOIDES, Nees ab Esenb.! in Linnæa, XX., p. 196, sine descr.: caule funiculari; floribus subsessilibus cymoso-spicatis; calycis globosi lobis orbiculatis concavis imbricatis verrucosis corollæ tubum latum breviter cylindricum includentibus; laciniis ovatis obtusis vix basi imbricatis erectis tubum æquantibus; antheris cordato-ovatis ad faucem sessilibus; squamis tenuissimis apice truncato pauci-dentatis tubo brevioribus; stylo ovario ovato-conico æquilongis, stigmate capitato bilobo; capsula ovata; seminibus ovato-triangulatis tenuiter verruculosis.

Cape of Good Hope; primitive forests of Uitehage, Drege, 8037; Hangklipp, Mund & Maire; Zeyher II. 3631 (120.5).—Flowers in spiked cymules, 1¾ lines long, shorter than in the

the large, oval, deeply fringed scales; the oval, slightly conic ovary. Seeds 0.6–0.9 line long, obliquely oval, rarely rostrate, with an oblong-linear, usually perpendicular hilum.—The following varieties may be distinguished:

Var. α. VULGIVAGA, the common form, as described and figured in Sill. Journ. and Chois. Cusc.; it is Willdenow's original *C. Gronovii*, in his Hb. nro. 3160, a very loosely flowered specimen.—On coarse herbs and shrubs, commonly in moist shady places, from Canada and Maine to Florida, westward to Missouri, Arkansas and Texas; I have seen no specimens from the Rocky Mountains or from the Pacific coast. Flowers 1¼–1½ lines long; lobes of calyx usually carinate and like the laciniæ shorter than the very deeply campanulate tube of the corolla; scales mostly shorter than the tube, incurved over the ovary; corolla remaining at base of capsule. Variable in the size of the flowers; a small flowered form is *C. polyantha*, Shuttlew.! in Pl. Rugel from Alabama; sometimes it occurs with 4-parted flowers, var. *tetrameris*, Engelm. l. c.

Var. β. LATIFLORA, *C. Saururi*, Engelm.! l. c. p. 336, t. 6, f. 17–21; calyx more membranaceous; laciniæ and stamens of equal length, as long as the shallow tube; scales narrow and longer than the tube; in eastern specimens the flowers are smaller, in western sometimes larger than in var. α.—From Massachusetts to North Carolina and westward to Illinois and Missouri.

Var. γ. CALYPTRATA; *C. Bonariensis*, H. B. Carlsr. al.; *C. Chilensis*, H. B. Frib. al., not Ker.; similar to the first form, flowers even more deeply campanulate, usually glandulous, rather larger, in very loose panicles; corolla remaining on top of capsule.—Western Louisiana, Gregg! Texas, Lindheimer! cultivated in several botanical gardens in Germany.

Var. δ. ? CURTA; *C. umbrosa*, Hook. l. c. in part; flowers small, 1¼ lines long, glandulous; calyx and short broadly oval laciniæ half as long as the deeply campanulate tube; anthers triangular cordate; scales very short, bifid or truncate, appressed to the tube; styles ⅓ or ¼ as long as the conic ovary; corolla surrounding or covering the upper part of the large oval capsule; intrastylar opening large; seeds few and large, nearly 1 line long, compressed, somewhat rostrate, with a small, oblong, transverse hilum.—Northwestern America, Douglas! Fremont! 79 (1845).—Perhaps a distinct species, taking the place of *C. Gronovii* on the Pacific side of the continent.

61. C. ROSTRATA, Shuttleworth! in sched., Engelm.! in Bost. Journ. n. h., V. 225; *C. oxycarpa*, Engelm! in sched. —In shady woods, on tall coarse herbs, rarely on shrubs,

southern Alleghanies from Maryland and Virginia to South Carolina, Rugel! Buckley! Gray & Sullivant! Curtis!—Nearly allied with the last, but flowers larger and wider, 2–3 lines long, scales comparatively small, deeply incised-fringed; ovary elongated, bottle-shaped; capsule, with the elongated 2-pointed beak, 2½–3 lines long; seeds 1-4, when regularly developed 1–1¼ lines long, obliquely obovate, compressed, carinate on the inside, bluntly rostrate, somewhat reticulate, with a short oblong linear mostly transverse hilum.

§ 3. Lepidanche.

Flowers pedicelled or, mostly, closely sessile; sepals free, similar to the surrounding sterile bracts, imbricate; ovary and capsule more or less conic, thickened and fleshy at the apex; withered corolla covering the capsule like a hood.—*Lepidanche*, Eng. Sill. Jour. 43, p. 343.

* Flowers pedicelled, loosely paniculate.

62. C. CUSPIDATA, Engelm.! in Bost. Journ. n. h., V. p. 224; Bot. Zeit. 1846, p. 277.—Parasitic on *Iva*, *Ambrosia* and many other herbs, on wet or dry prairies from southern and western Texas, Lindheimer! 125 and 277, Wright! Schott! Thurber! to the upper Arkansas, Trécul! Fendler! N. Mex. 659,b; Marcy! Bigelow! and to the sandhills of the Platte, Hayden!—A well marked and easily recognized species; inflorescence loosely paniculate, with many sterile hyaline bracts on the pedicels and at the base of the calyx; flowers membranaceous, 1½–2¼ (mostly 2) lines long; upper bracts and sepals ovate or orbicular, cuspidate or sometimes obtuse; ovary not globose, as I formerly described it, but oval, with a thick stylopodium; capsule thick and glandulous at the apex; seeds rarely more than 0.4 line long, obovate, compressed, rostrate, with a very short oval mostly transverse hilum. The form from Platte river has the smallest flowers, and almost orbicular sepals.

63. C. BRACTEATA, n. sp.: caulibus tenuiter filiformibus; cymis spiciformibus paniculatis; pedunculis pedicellisque crassis bracteis pluribus ovatis obtusis, superioribus lanceolatis acutatis stipatis; sepalis similibus longioribus acuminatis serrulatis tubum corollæ subcylindricum æquantibus; laciniis lanceolatis acuminatis tubo brevioribus reflexis; staminibus multo brevioribus, antheris oblongo-ovatis filamento æquilongis; squamis ovatis crispato-laceris medio tubo adnatis faucem attingentibus; stylis capillaceis ovario minuto multo longioribus inclusis, stigmatibus ovato-capitatis.

Goyaz, Brazil, parasitic on shrubs, Gardner! 3348 in Hb. Hooker.—Similar to the last, but flowers much larger, 2½–3 lines long in a rather contracted inflorescence; peduncles remarkably thick in proportion to the stems; stigmata oval, almost twice as long as they are thick, a form that I have not seen in any other species. The only specimen examined is barely in flower; the ovary is probably shaped as in the last species.

** Flowers closely sessile, crowded in compact and often continuous clusters.

64. C. SQUAMATA, n. sp.: caulibus filiformibus aurantiacis; glomerulis compactis; bracteis 2–5 sub flore singulo arcte sessili late ovatis cuspidatis membranaceis adpressis sensim in sepala exteriora similia et interiora longiora obtusiora tubum cylindraceo-obconicum æquantia transeuntibus; staminibus brevioribus, antheris oblongo-linearibus filamenta subulata æquantibus; squamis ovatis laciniato-fimbriatis medio tubo adnatis faucem excedentibus conniventibus; stylis capillaceis ovario ovato-conico multo longioribus exsertis; capsula ovata apiculata 1–2–sperma corollæ rudimentis calyptrata; seminibus subglobosis lenticularibusve, hilo oblongo abbreviato.

Fields and wastes on the Rio Grande, on *Artemisia Ludoviciana*, *Helianthus ciliatus* and other weeds, from El Paso, Wright! 518 (coll. 1849) and 1628 (coll. 1852), Bigelow! Thurber! down to Presidio del Norte, Parry!—Clusters 5–6 lines in diameter, consisting of 8–12 flowers; or sometimes small, only 2–3-flowered; occasionally continuous, in the manner of the next species; flowers 2½ lines long, similar in shape to those of the two last species, but closely sessile, in other respects much like the next, but bracts appressed, not squarrose. Seeds 0.6–0.7 line long; subglobose when the capsule has only 1 seed, compressed when it contains 2, oblique but scarcely rostrate, with a very short oblique or transverse hilum, almost a mere dot.

65. C. GLOMERATA, Choisy! Cusc. 184, t. 4, f. 1; DC. Prod. IX. 458; *Lepidanche Compositarum*, Engelm.! Sill. Journ. 43, p. 344, t. 6, f. 30–35; *C. Americana* (*monstruosa*), Hook. in Comp. Bot. Mag. I. 173; *C. paradoxa*, Rafin. Ann. nat. 1820, p. 13, & DC. l. c. 461?—Prairie regions of central North America, on *Helianthus*, *Solidago*, *Vernonia*, *Silphium* and other tall *Compositæ;* rarely parasitic on any other plant: from Indiana, Dr. Clapp! to Illinois and Missouri, Drummond! Engelm.! Riehl! 15 & 16; Kansas, Hayden! the upper Arkansas region, Fendler! 657; southward to the Canadian, Bigelow! and to the Liano in western Texas, Lindheimer! Mr. Riehl found it very destructive to the pear seedlings in his nursery.—This, the most striking of all *Cuscutæ*, has been so fully described, that very little is to be

added. The glomerules almost always form two parallel lines on both sides of the stem, wherever it is attached to the stem of the nurse and somewhat flattened, rarely in detached clusters, where the stem is free; these clusters of flowers run completely together and form at last a continuous spiral coil, 6–10 lines in thickness, and several inches in length; the orange-red filiform stems have by this time entirely disappeared.—Flowers 2½–3 lines long, surrounded by numerous squarrose bracts; lobes of corolla obtuse, not acute; stylopodium larger, (Sill. J., l. c. f. 33) or smaller (l. c. f. 34) than ovary proper; flowers often sterile; seeds 2 or mostly 1 in each capsule, 0.5 line long, oval, more or less compressed, very slightly rostrate, small oval hilum transverse.

Rafinesque was no doubt the first to distinguish this species, and his name, a very appropriate one, would have the precedence over the later ones, if he, by his very incorrect description, had not enveloped the whole in so much obscurity, that Choisy's later name is to be preferred.

66. C. COMPACTA, Jussieu! in Hb.; Choisy! Cusc. 185, t. 4, f. 2; DC. Prod. IX. 458; Engelm.! Bost. Journ. N. Hist., V. 225; *C. remotiflora* and *C. Fruticum*, Bertol. Misc. bot. X. 29; *C. Americana*, auct. var.; *C. imbricata*, Nutt.! in Hb.; *C. coronata*, Beyr.! in Hb.—From the banks of the St. Lawrence in the State of New York southward, and on the Alleghany mountains from Pennsylvania to Georgia and Alabama, almost entirely on shrubs, such as *Corylus*, *Alnus*, *Andromeda*, etc.; only accidentally on herbaceous plants.—Clusters in fruit often ¾–1½ inches in diameter, continuous and thickest where the stem is twined around the nurse, but also abundant where it is free; tube of corolla slender, laciniæ oblong; dead corolla raised on top of the acutish capsule, giving it a pointed appearance; seeds 1–2, rarely 3-4 in each capsule, 0.8–1.0 line long, oval oblique, lenticular or carinate inside, scarcely rostrate; hilum small, oblong, perpendicular or transverse.

Var. β. ADPRESSA; *Lepidanche adpressa*, Engelm.! in Sill. Journ. 45, p. 77; *C. acaulis*, Raf. Ann. Nat. 1820, p. 13?—Shady woods in rich bottom-lands along streams in the Mississippi valley, on *Cephalanthus*, *Cornus*, *Salix*, *Bignonia*, *Vitis*, *Rhus Toxicodendron*, *Smilax* and some herbaceous plants; western Virginia to Illinois and Missouri, and southward to western Louisiana and Texas.—Tube of corolla wider, more deeply immersed in the calyx, lobes broader, capsule thicker, not so much pointed and corolla not so much raised above it, so that the clusters, especially in fruit, appear more obtuse; seeds of same size as in α., usually 2–4 in a capsule, compressed, scarcely carinate, with a longer, transverse hilum. The difference in the seeds appears to be constant, and proves again that in this genus not much reliance can be put on characters derived from them.

Sec. 7. *Lobostigma.*

Styles of nearly equal length, clavate towards the flattened stigmatose top, which is divided into several unequal orbicular lobes and depressed in the centre; capsule baccate.

Inflorescence a loose fasciculate cyme, bracts at the base of the long pedicels; corolla enveloping and covering the capsule.

The only species of this section is a native of Tasmania.

67. C. Tasmanica, n. sp.: caulibus capillaceis; cymis laxifloris umbellato-fasciculatis compositis; pedicellis elongatis clavatis in calycem turbinatum profunde fissum abeuntibus; floribus glandulosis; lobis calycis oblongis obtusis tubum æquantibus; laciniis oblongis obtusis patulis seu demum reflexis tubo longioribus; staminibus brevioribus conniventibus, antheris oblongo-linearibus filamento crasso longioribus; squamis augustis apice fimbriato bifidis faucem æquantibus; stylis ovario subgloboso fere longioribus exertis. —*C. australis*, Hook. fil! Fl. Tasm. 278, not R. Br.

Hobartstown, Tasmania, Gunn! 1991, in Hb. Hooker.—Well characterized and distinguished from any other species by the shape of the stigma. Fascicles of 4–8 flowers aggregated in larger cymes; flowers $1\frac{1}{2}$–$1\frac{3}{4}$ lines long, usually 5-parted; anthers turned inward, with a very broad commissure on the back; scales crenulate on the sides, deeply fringed and usually bilobed at the tip; styles nearly as long as lobes of corolla, much longer than the stamens, stigma commonly with 4 unequal lobes; styles in fruit subulate from a broad divaricate base, distant from another, with a small aperture between them; no ripe seeds seen.

Sec. 8. *Monogynella.*

Styles united entirely or for the greater part of their length, thick and compressed; stigmata capitate, subglobose or ovate, distinct or more or less coalescent. Capsule regularly circumscissile, usually 2-seeded; dissepiment of the shape of the capsule, transparent, with a thicker rim, entire, no part adhering to the base of the style. Seeds compressed, oblique, more or less rostrate, with a long linear transverse hilum. Anthers sessile, or on very short filaments, often attached to the tube below the throat.

Stems thick; flowers comparatively small, always 5-parted, sessile or on short pedicels, supported by bracts, in small cymules, which form a compound spike or raceme; withered corolla remaining, hoodlike, on the very top of the large capsule.

Parasitic mostly on ligneous plants. Of the 8 species of this section, 5 belong to the continent of Asia, 2 of which extend into Europe; 1 is peculiar to the island of Timor, 1 to South Africa, and 1 to Texas.

68. C. EXALTATA, n. sp.: caule funiculari; floribus breviter pedicellatis seu sessilibus spicato-paniculatis; calycis globosi lobis fere disjunctis orbiculatis concavis imbricatis medio verrucosis corollæ tubum cylindricum æquantibus; laciniis orbiculatis imbricatis tubo multo brevioribus erectis seu erecto-patulis; antheris cordato-orbiculatis ad faucem sessilibus; squamis bipartitis dentatis tubo multo brevioribus; stylo apice bifido ovario ovato-globoso æquilongo, stigmatibus subglobosis.

Parasitic on *Diospyros Mexicana*, *Ulmus crassifolia*, *Quercus virens*, *Juglans*, *Rhus*, etc., 10–20 feet high, in western Texas, on the Guadaloupe and Cibolo, Lindheimer! 472; on the Colorado and Blanco, Wright! on the Leona and at the mouth of the Pecos, Bigelow! on the Rio Grande, Schott!—Stems 1–2 lines in diameter; compound panicles several inches in length; flowers 2 lines long, small tube hidden in the large calyx; anthers closely sessile; scales reduced to two dentate wings on the sides of the very distinct attached filaments, united at base; upper fourth of the thick style divided; stigmas depressed, thicker than the ends of the style; capsule 3½–5 lines long; seeds 1½–1¾ lines long, somewhat triangular, very slightly rostrate. The large embryo is coiled up in 2–3 rounds; on the upper (thinner) end 3–4 alternate scales may be distinguished. This is the only species of this section, where the styles are not completely united. I formerly distributed it under the the name of *C. gamostyla*.

69. C. CASSYTOIDES, Nees ab Esenb.! in Linnæa, XX., p. 196, sine descr.: caule funiculari; floribus subsessilibus cymoso-spicatis; calycis globosi lobis orbiculatis concavis imbricatis verrucosis corollæ tubum latum breviter cylindricum includentibus; laciniis ovatis obtusis vix basi imbricatis erectis tubum æquantibus; antheris cordato-ovatis ad faucem sessilibus; squamis tenuissimis apice truncato pauci-dentatis tubo brevioribus; stylo ovario ovato-conico æquilongis, stigmate capitato bilobo; capsula ovata; seminibus ovato-triangulatis tenuiter verruculosis.

Cape of Good Hope; primitive forests of Uitehage, Drege, 8037; Hangklipp, Mund & Maire; Zeyher II. 3631 (120.5).—Flowers in spiked cymules, 1¾ lines long, shorter than in the last species; scales united at base, ovate obtuse or truncate, scarcely dentate; styles united entirely; stigma divided almost to the base, lobes subglobose; capsule 3–4 lines long, subglobose; seeds of the size and shape as in the last species.

70. C. TIMORENSIS, Decaisne! Mss.: caule funiculari; floribus racemoso-spicatis seu axi indeterminata apice bracteata spicatis; pedicellis inferioribus longioribus bracteatis, superioribus brevissimis nudis, omnibus bractea ovato-orbiculata concava suffultis; calycis profunde partiti lobis orbiculatis concavis imbricatis tubum corollæ brevem campanulatum æquantibus; laciniis ovatis obtusis tubo brevioribus erectis seu sæpe patulis reflexisve; antheris cordato-ovatis tubo infra faucem adnatis; squamis ad cristulas binas convergentes reductis seu subnullis; stylo cum stigmatibus ovatis compressis ovarium subglobosum æquante; capsula ovata conica sub-2-sperma; seminibus orbiculato-triangulatis compressis.—*C. reflexa*, Dne.! in Hb. Timor. descr. p. 66, not Roxb.

Island of Timor, Leschenault! in Hb. Mus. Par.—The tendency to a regularly spiked inflorescence, which is observed in this whole group, is more decidedly developed in this species; the main axis of the inflorescence is terminated by an imbricately bracted bud, never by a flower; the lower lateral flowers open first, and the upper ones in succession; all, or only the lower ones, are supported by pedicels bearing lateral flowers; the upper ones often have shorter pedicels with 2 or 3 sterile bracts; the uppermost ones are commonly quite short and bractless. Flowers $1\frac{1}{2}$–$1\frac{3}{4}$ lines long; anthers almost sessile a little below the throat; scales very indistinct, consisting mostly of 2 slight ridges converging towards the base of each anther; stigmas of the length of the style and scarcely thicker, oval and compressed; capsule about 3 lines long; seeds $1\frac{1}{4}$ lines in diameter.

71. C. MONOGYNA, Vahl. Symb. II., 32; DC. Prod. IX. 450, & auctt. in part; *C. orientalis*, Tournef.! Cor. 45; Sibth.! in Hb. Jacq.; *C. astyla*, Engelm.! Bot. Zeit., 1846, IV. 276; *Monogynella Vahliana*, DesM.! Et. 65; *C. scandens*, Brot. Lusit. I. 208??—On shrubs and trees, as *Salix*, *Tamarix*, *Pistacia*, *Vitis*, etc.; also on herbaceous plants, *Euphorbia*, etc.; from southern Europe through middle Asia south-eastward: (Portugal? Brot.); southern France, almost always on the grape vine (introduced?), Delisle! Requien! etc.; Rumelia, Frivaldski! specimens often mixed with *C. Europæa;* Crimea, Trautvetter; Greece, Heldreich! Orphanides! Asia Minor, Sibthorp! Wiedemann! Syria, Tournefort! in Hb. Banks, Labillardiere! Blanche! Caucasus and Georgia, Hohenacker! Prescott! Wilhelms! Frick! Koch! Soongaria Schrenk! Persia, Buhse! Noë! Kotschy! 713,

Affghanistan, Griffith! 682 & 684.—Vahl's description, "dentibus corollæ lanceolatis," etc., does not exactly agree with our plant, nor is Sibthorp's figure, Fl. græc. t. 257, very correct; but the locality of the former and an authentic specimen of the latter (in Hb. Jacq.) leave no doubt that both had the plant in view which I formerly distinguished as *C. astyla*.—The inflorescence is a compound spike consisting of a terminal and several lateral cymes of 2–3 or 4 sessile flowers; the lowest cymes open first and are sometimes branched. Flowers 1¼–1½ lines long; corolla 1–1¼ line in length; laciniæ oval or orbicular, very obtuse, delicately crenulate, erect, scarcely more than half as long as the tube, which is entirely enclosed in the calyx; anthers ovate or triangular-ovate, cordate at base, almost sessile a little below the throat; scales attached to the middle of the tube, of the shape of a horseshoe, forming a narrow denticulate or slightly fimbriate border, which is sometimes truncate or even bifid; style very short, equal in length to the subglobose 2-lobed stigma, much shorter than the oval or globose ovary; capsule 2–3 lines long, usually oval and obtuse; seeds rarely more than 2, ovate, strongly rostrate, slightly rough.—*Mon. Blancheana*, DesM.! in lit. is a form with a somewhat elongated conic capsule, which occurs in Syria and Georgia, and which approaches the next species.

72. C. Lehmanniana, Bunge! in Lehm. rel. in Mem. sav. ét. VII. 396.—Bokhara, on the banks of the Jan-Darja, A. Lehmann!—Flowers pedicelled in a thyrsoid inflorescence, slender, 2½–2¾ lines long; corolla 2–2¼ lines in length; laciniæ oval, crenulate, shorter than the tube, erect or spreading; scales horseshoe-shaped, attached to the middle of the tube and covering the base of the ovate-cordate anthers, which are sessile below the throat; style much shorter than the oval or subglobose ovary, of the length of the distinctly 2-parted oval stigma; capsule oval. The shape and proportion of the corolla is similar to that of the next species, especially of its Asiatic form; the pistil is like that of the last species; the position of scales is quite peculiar. I class with this a form from Asia Minor:

Var. β. esquamata: pedicels as long as, or often longer, than the calyx; oblong lobes of the corolla still more distinctly crenate, not much shorter than the tube, spreading, on the fruit erect or twisted; anthers still shorter; scales almost entirely adnate, commonly showing only a denticulate crest on both sides; stigma globose or oval, almost sessile.—On *Pistacia Terebinthus*, on mount Sipyle, near Magnesia, Balansa! 411.—Flowers 2½ lines, corolla 2 lines long, more deeply divided than in the allied species.

73. C. LUPULIFORMIS, Krocker! Siles. I. p. 261, t. 36; *C. monogyna*, auctt. Fl. germ. al.—On willows, etc., on the banks of streams from eastern and north-eastern Germany, Silesia, where it seems to be common on the Oder, Lessing! Gœppert! Günther! al., Bohemia and Austria, Kovats! to Hungary, Gerenday! and to central Russia, Kasan, Graff!—Flowers subsessile or on at last slightly elongated pedicels; cymes forming elongated spikes, or sometimes more or less compound racemes, which are always terminated by a 2 or 3-flowered cyme; flowers 2–2½ lines long; lobes of calyx oval, obtuse or almost pointed, half as long as tube of corolla; laciniæ oblong obtuse, erect, half as long as tube; anthers oblong-linear, sessile below the throat; scales short, attached to the lower part of the tube, bifid or reduced to lateral crenulate wings; ovary oval, conic, attenuated into the slender style, which is much longer than the globose or oval deeply bilobed stigma. Capsule conic, 3–4 lines long; seeds triangular oval, rostrate, 1¼–1½ lines long.

Var. β. ASIATICA: flowers often longer and more slender, on longer pedicels; laciniæ more crenulate and somewhat spreading; anthers on short but distinct filaments; scales entire, broadly oval, fimbriate and somewhat incurved. *C. flava*, Siev. ap. Pall. probably belongs here.—On *Tamarix*, *Salix*, etc., from the banks of the Wolga, Fischer! Becker! where it seems to join the western form, eastward through the southern parts of Asiatic Russia, Caucasus, Hb. Hooker! Soongaria, Schrenk! 229 & 306, b. (the last a form with very slender flowers and longish pedicels); Buchtarminsk, Karelin & Kiriloff! 926; Altai, Ledebour! Bunge! Gebler! 180, to the river Angara, Turczaninoff!

C. lupuliformis, having been published as early as 1787, has by 4 years the priority over Vahl's name, *C. monogyna*, published in 1791, and must stand for the species with all those botanists who consider both plants as identical; but it so happens that *C. lupuliformis* properly designates the species which in Europe and Asia extends north of the 43d or 44th degree, and *C. monogyna* that which grows south of that latitude.

74. C. GIGANTEA, Griffith, notul. I. 243.—On *Tamarix* Siah-sung ravine, Affghanistan, 10,300 feet high, Griffith! 1031 (683).—Griffith's specimens corresponding best with his description are all parasitic on *Tamarix* and not on *Salix* or *Populus*, as he says in his Notulæ, nor are the stems very thick, but rather filiform; otherwise his detailed description, especially that of the corolla, the scales and the stigmas, agrees so well with his specimen in question, that I can not doubt about his having it in view; but he may have con-

founded it with *C. monogyna*, which he has collected on willows.

The inflorescence forms racemose spikes after the manner of this section, but shorter, only ½–¾ inch long, flowers 2½–2¾ lines long, membranaceous, on short pedicels; calyx covering one half of the tube; laciniæ linear-oblong, obtuse, crenulate, a little shorter than the tube, spreading, or reflexed; ovate-cordate anthers very large, subsessile a little below the throat; scales oval, fimbriate, reaching from the base to the middle of the tube; style as long as the conic ovary and the oblong, elongated, somewhat ligulate (linguiformia, Griff.) stigmas.

75. C. JAPONICA, Choisy! Pl. Zoll., 1854, p. 130 & Pl. Jav. 1858, p. 30.—This species extends in several forms along the whole coast of China and to Japan; all the different varieties are characterized by a very short cupulate calyx, with rounded, mostly cristate lobes, which cover scarcely more than ¼ of the corolla; by the oval or rounded, very slightly crenulate, sometimes cuspidate, spreading or reflexed laciniæ, which have ¼ or ⅓ the length of the cylindrical or slightly widening tube; by the oval anthers, sessile or subsessile at the throat; by the entire, ovate, fimbriate, incurved scales; by the elongated style, with 2 ovate, more or less conic or subulate, stigmas. Flowers 2½–3 lines long.

Var. *α*. THYRSOIDEA: flowers subsessile with several bracts at base, in a compact, thyrsoid raceme, often 2 inches long and ½ inch thick; scales from the lower part of the tube, reaching almost to the base of the anthers; styles longer than the conic ovary; stigmas short and conic.—This is Choisy's original *C. Japonica*, and also *C. reflexa*, var. *densiflora*, Bentham! in Hb.—Japan, Zollinger! 355; Hongkong, Abbé Furet! Maj. Champion! 457.—*C. systyla*, Maximowitsch! Primit. Fl. Amur. ined., from the lower Amur, is exactly the same plant, with shorter scales, and rather oval than conic stigmas. From *C. lupuliformis*, var. *Asiatica*, to which it closely approaches, it is distinguished by the short calyx and the shape and insertion of the stamens.

Var. *β*. PANICULATA: flowers on short pedicels, scarcely bracted at base, in a loosely flowered panicle, 1–2 inches long and of the same diameter; narrow scales reaching from the base to the middle of the tube; stigmas conic-subulate, as long as style and as ovary.—*C. colorans*, Maxim.! l. c.—Pekin, Kirilow! in Hb. Fischer, now Hb. H. B. Petrop.

Var. *γ*. ? FISSISTYLA: inflorescence same as last; scales from the middle of the tube, not reaching the base of the anthers, broad and often partly confluent; styles united only at their lower third; stigmas conic.—Hongkong, Chas. Wright! U. S. North Pacif. Expl. Exp., nro. 486.

The subulate or conic stigmas, and the often more paniculate than spiked inflorescence, indicate a close approach to the next species, which to Mr. Bentham was so evident, that he considered our plant a mere variety of it; but the structure of the capsule, with the corolla persisting on its top and the dissepiment in its base, shows that it truly belongs to *Monogynella*. The dissepiment is membranaceous, with a thicker centre, but without the thick frame-like border of the allied species.

Sec. 9. *Callianche.*

Stigmata distinct, elongated, conic or subulate, sessile or almost sessile. Capsule regularly circumscissile, usually 4-seeded, dissepiment extremely thin, partly evanescent, stylar portion small. Seeds compressed, rostrate, angled on the inside, with a long, linear, transverse hilum.

Flowers large, 5-parted, usually on bracted pedicels in compound loosely paniculate cymules; corolla deciduous after flowering.

The only species inhabits East-India and the adjoining islands.

76. C. REFLEXA, Roxb. Corom. 104; Fl. ind. I. 446.—This beautiful species bears the largest flowers of any, in different varieties from 3–5 lines long; calyx with oval or mostly rounded, very often cristate or verrucose lobes, much shorter than the cylindric tube of the corolla; laciniæ spreading or reflexed, on the margin revolute, much shorter than the tube; anthers oval to oblong-linear, sessile or subsessile; scales in the base of the tube, about ½ or ⅓ its length, with short and delicate curly fringes, curved; ovary oval, acutish, often attenuated into a short, slightly bifid style, or with sessile stigmas; capsule subglobose, about 4 lines in diameter; at maturity, only the lowest part of the thin dissepiment remains; seeds 1½ lines long.—The following forms are specifically distinguished by most authors; Choisy, however, in Pl. Zoll. already suspected their identity, and different as they seem to be at first sight, I can not but consider them as mere varieties.

Var. *a.* GRANDIFLORA; *C. grandiflora*, Wall.! Cat. nro. 1318, not H.B.K.; *C. macrantha*, Don.! gen. syst. IV., 305; DC. Prod. IX. 455; *C. megalantha*, Steud. nom.; *C. elatior*, Choisy! Cusc. 177.—Flowers of the largest size; laciniæ ⅓ or sometimes only ¼ the length of the tube; anthers elongated, on very short filaments separating from the tube below the throat; stigmas elongate, subulate, divaricate, usually on a very short style. This is no doubt Roxburgh's original *C. reflexa*, as his figure and description, "stigmata large, spreading, pointed," prove.—In the temperate as well as the tropical parts of India, from the Himalaya, Wallich! 1318 & 1319[2]; Lady Dalhousie! Jacquemont! 1109 & 2183; Strachney & Winterbottom! 1 & 2; Hofmeister! Hooker, f. & Thomson! Sikkim, the same! Khasia, the same! to the low lands of the coast of Coromandel, Roxburgh, and to Ceylon, Gardner! 616; Thomson! and Java, Zollinger! 2839.—The specimens from the islands are remarkably stout, and have a larger calyx than the ordinary form. It often occurs with verrucose bracts, pedicels, and calyx or even verrucose stems; this is *C. verrucosa*, Sweet, Fl. gard. t. 6, not Engelm.; *C. Hookeri*, Sweet, hort. br. p. 290; *C. reflexa*, var. *verrucosa*, Hook.! fl. exot. t. 150.

Var. β. BRACHYSTIGMA; *C. reflexa*, Wallich! Cat. in part, Edgeworth! in Lin. Trans., Choisy, DC. Prod. l. c., and most authors, not Roxb., *C. pentandra*, Heyne! in Hb. H. B. Petrop.—Flowers smaller; laciniæ ½ or ⅓ the length of the tube; anthers shorter, sessile at the throat of the corolla; stigmas short, conic, closely sessile, erect.—Calcutta, Gaudichaud! 129, and valley of the Ganges in general, Jacquemont! 149 & 2520, de Silva! in Wall. Cat. 1319[1], to the Punjab and the western Himalaya, Hooker, f. & Thomson!

Jacquemont, 149, from Bengal, has the corolla and anthers of var. α, and the short erect stigmas of var. β; style distinct, almost as long as the stigmai.

C. anguina, Edgeworth! Trans. Lin. Soc. XX., 86, from the Himalaya, is a small flowered form with more deeply divided tube, otherwise the same as var. β.

C. aphylla, Raf. in Spr. n. Ent. I. 145, and DC. Prod. IX. 461, from the Wabash, is perhaps the same as *C. glomerata*.

C. Epibotrys, *Uva barbata* or *Ampelepogon*, is the name given to the numerous capillary stems of a *Cuscuta* which occasionally have been found parasitic on the unripe berries of the grape vine; they often seem to be without flowers; in one instance they have been ascertained to belong to *C. Epithymum*.

C. subuniflora, Koch, in Linnæa XXII. 748, from Asia Minor, I have not seen; it may be a depauperate form of *C. brevistyla*.

C. triflora, E. Mey. in Pl. Drege, from the Cape of Good Hope, is, as well as *C. funiformis*, Willd., a species of *Cassyta*.

ADDENDA.

Page 459, *Cuscutina*, Pfeif. Bot. Zeit. 1846, p. 461, is another synonym of *Grammica*.

Page 467, add to *C. Palæstina*: *C. globularis*, Bert. Fl. it. VII. 625, is the same plant.

Page 478, after *C. odorata*, introduce:

20. b. C. GLOBIFLORA, n. sp.: caulibus filiformibus crassiusculis; glomerulis paucifloris compactis; floribus subsessilibus bractea una alterave orbiculata concava suffultis; calycis fere ad basin fissi lobis orbiculatis imbricatis margine tenuissimo ciliolatis tubum corollæ ventricosum globosum subæquantibus; laciniis ovato-orbiculatis crenulatis imbricatis erectis seu conniventibus tubo brevioribus; antheris ovatis filamento brevissimo longioribus; squamis magnis ovatis breve fimbriatis faucem pene attingentibus; stylis ovario globoso æquilongis.

Cuzco, Bolivia, at an elevation of 11–12,000 feet, Pentland! in. Hb. Hooker.—Glomerules in the single specimen seen 6–7 lines in diameter, consisting of 2–5 flowers; flowers with the thick calyx and the surrounding bracts almost globose, 3–3½ lines long, a little less in diameter; corolla really ventricose or urceolate; ovary globose or even depressed; I could not ascertain whether the styles become subulate; stigmas small and slightly conic; in the dried state, the young capsule seems to be circumscissile even long before maturity; corolla apparently covering the capsule. Evidently closely allied with *C. odorata*, to which in habit and inflorescence it bears a great resemblance.

Page 478, add to *C. Chilensis:*

C. odorata, Choisy! Cusc. 180, t. 2, f. 4; DC. Prod. IX. 456; Gay! Fl. Chil. IV. 447, not Ruiz & Pavon, according to the description and figure of Choisy and the authentic specimens in Hb. DeCandolle, does not essentially differ. The specimens of Gay, 816 & 817 and of Bertero, 940, have a thinner, more membranaceous texture than the ordinary *C. Chilensis*, but Gaudichaud's specimen is absolutely identical with it.

Page 482, *C. graveolens*, H.B.K.! n. gen. sp. III, 122, is the same as *C. Americana*.

Page 493, l. 13, read *Rogovitschiana* for *Regowitschiana*.

INDEX.

The names of the Genera and Sections are in full capitals, of the Species in small capitals, of the Synonyms in common type.

METEOROLOGICAL TABLE for 1858, MADE FROM OBSERVATIONS IN ST. LOUIS, by DRS. WISLIZENUS AND ENGELMANN.

MONTHS.	BAROMETER, Reduced to Freezing Point.				THERMOMETER, (Fahrenheit.)					EVAPORATION.	FORCE OF VAPOR IN INCH'S.	RELATIVE HUMIDITY.	QUANTITY OF RAIN AND SNOW.	PREVAILING WINDS.	AM'T OF CLOUDINESS.	THUNDERSTORMS.
	Monthly mean of daily observations at 7, 2 and 9 o'clock.	Highest.	Lowest.	Range.	Monthly mean of daily observ. at 7, 2 & 9.	Monthly mean of daily observations at sunrise & at 2 o'cl.	Highest.	Lowest.	Range.	Monthly mean.	Monthly mean.	Monthly mean.	Month. total in inches.	Monthly mean.	Monthly mean.	
Jan.	29.599	30.114	28.890	1.224	40.5	40.9	62.0	24.5	37.5	3.8	0.169	67.7	3.42	W. & S.E.	5.4	
Feb.	29.618	29.996	29.113	0.883	27.2	27.3	55.0	**0.0**	55.0	1.2	0.128	86.7	2.12	W.	6.0	
Mar.	29.555	29.956	29.181	0.775	47.8	47.3	76.0	11.0	65.0	5.7	0.196	59.3	3.96	E. & S.W.	4.5	1
April	29.377	29.834	**28.792**	1.042	57.7	57.0	84.0	34.5	49.5	7.1	0.278	59.7	6.07	S.W.	6.6	4
May	29.450	29.799	29.088	0.711	64.0	63.3	88.0	44.0	44.0	5.9	0.409	69.3	10.64	S.W.	5.7	7
June	29.493	29.714	29.189	0.525	76.5	74.9	95.5	50.0	45.5	6.4	0.638	70.3	6.69	S.	4.6	9
July	29.505	29.685	29.318	0.367	82.2	81.0	**99.0**	62.0	37.0	8.0	0.738	67.8	8.03	N. & S.E.	3.6	2
Aug.	29.556	29.844	29.348	0.496	78.7	78.0	98.0	51.0	47.0	8.6	0.621	65.0	2.87	S. & N.	3.3	4
Sept.	29.573	**30.129**	29.301	0.878	71.3	71.1	93.0	47.0	46.0	7.9	0.482	64.3	3.86	S.	2.2	4
Oct.	29.548	29.801	29.260	0.541	58.6	58.7	89.5	37.5	52.0	5.3	0.339	69.3	7.73	S.E.	5.2	3
Nov.	29.546	29.939	29.164	0.775	37.6	37.8	57.0	17.0	40.0	2.0	0.183	81.0	4.92	W.	7.8	
Dec.	29.574	30.174	28.986	1.188	38.3	38.3	56.0	12.5	43.5	2.4	0.179	78.3	8.52	S.W.	5.3	
1858	29.533	30.179	28.792	1.387	56.7	56.3	99.0	0.0	99.0	5.4	0.363	69.9	68.83	S.W.	5.0	34

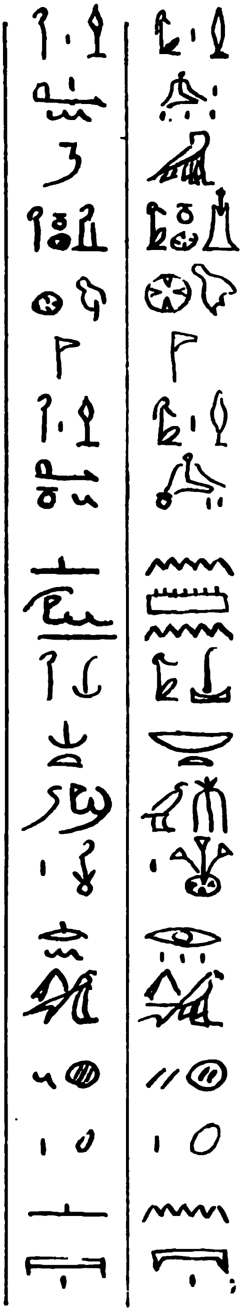
* The observations from January to October were made by Dr. Wislizenus, and those in November and December by Dr. Engelmann.

PREVAILING WINDS IN 1858.

(*By* 1095 *Observations.*)

1858.	N.	E.	W.	S.	N.	E.	W.	S.
Jan.	14.5	20.5	33.0	25.0				
Feb.	13.0	18.0	34.0	19.0				
Mar.	18.5	27.0	23.0	24.5	46.0	65.5	68.5	90.0
April	17.0	20.5	25.5	27.0				
May	19.5	18.5	26.0	29.0				
June	13.0	20.5	14.0	42.5	49.5	59.5	98.5	65.5
July	26.5	25.5	15.5	25.5				
Aug.	27.0	22.0	17.0	27.0				
Sept.	13.0	20.5	22.0	34.5	66.5	68.0	87.0	54.5
Oct.	9.5	30.0	25.0	28.5				
Nov.	10.5	13.5	45.0	21.0				
Dec.	8.0	23.0	27.5	34.5	28.0	66.5	84.0	97.5
Suma:	190.0	259.5	307.5	338.0	190.0	259.5	307.5	338.0
per cent	17.3	23.7	28.1	30.9				

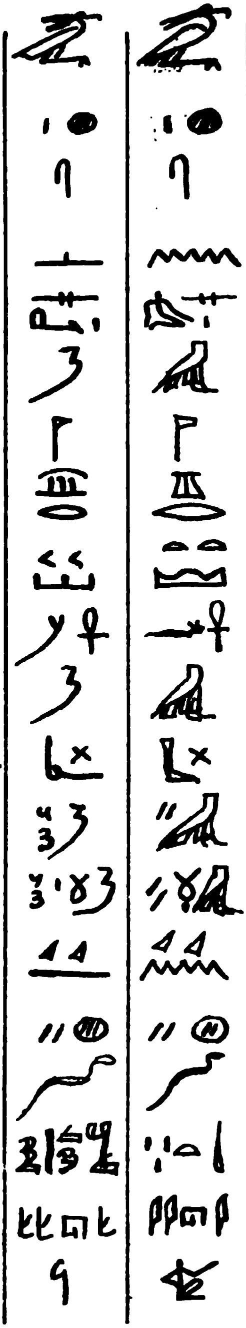
34	ⲟⲩⲟⲧ	*honoring*
35	ⲙⲟ-ϥ	*him (and)*
36	ϭⲟⲓⲗⲉ.ⲁϩⲓ-ϥ ϩⲁⲙ	*his house of light,*
37	ϩⲱⲛ	*(and) ordered*
38	ⲁⲧⲟⲟⲩⲉ-ϥ	*by his father,*
39	ⲟⲩⲣⲟ-ϩⲣⲱ ϩⲁⲙ	*the Lord governor;*
40	ⲁⲩⲱ	*and also*
41	ϣⲟⲡ	*the originator*
42	ϣⲟⲧ ϩⲁⲙ	*of the priests*
43	ⲃⲱⲧⲉ-ϥ	*for his race*
44	ϩⲙ	*in the*
45	ⲧⲁϫⲣⲟ	*firmament,*
46	ⲙ	*(and) for*
47	אדן ⲟⲩⲣⲟ	*Adon, the Lord;*
48	ⲛ	*(who made) the*
49	ⲙⲏⲛⲓⲙⲉϩⲁⲙ	*Moon,*
50	ⲉⲣⲉ	*the builder*
51	פִּשְׁתָּא	*of the flax seed,*
52	ϣⲗⲟⲗ	*(and) her sex*
53	ⲙ	*of the*



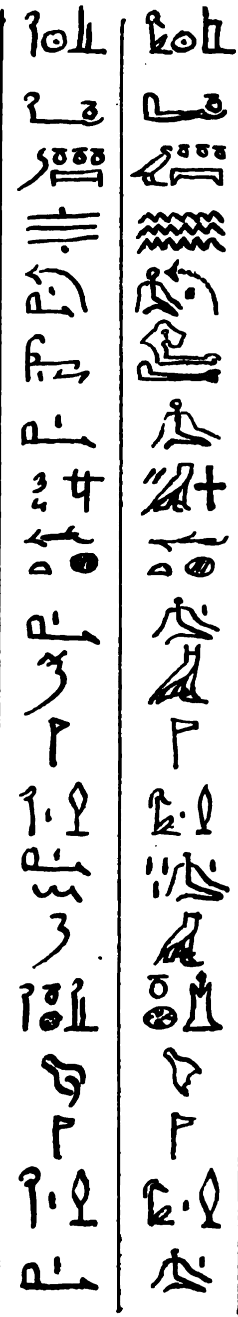
74	ⲕⲏⲙⲉⲡⲉϩⲁⲙ	*the Egyptians*
75	ⲙⲏϣ ⲡⲉ ⲟⲩⲓ	*the mighty*
76	ϩⲙ	*in*
77	ⲱⲛ ⲃⲁⲕⲓ	*the city of the Sun,*
78	ⲛⲏⲃ ⲃⲁⲕⲓ	*the capital city*
79	ϩⲧⲟⲣ	*of the sovereign*
80	ⲕⲏⲙⲉⲡⲉϩⲁⲙ	*of Egypts*
81	ⲙⲏϣ 2 ⲛ	*mighty both,*
82	ⲛ	*the*
83	ⲙⲁⲛ	*shepherd-*
84	ⲙⲟⲛⲉ ϩⲁⲙ	*man,*
85	ⲛⲓⲃⲉⲛ	*of all*
86	ⲙⲁⲥ.ⲟⲩⲓ	*being born*
87	ⲕⲏⲙⲉ ⲃⲁⲕⲓ	*in Egypt (and)*
88	ⲃⲟⲗ ⲟⲩⲓ	*vicinities (namely),*
89	ϩⲱⲣ	*Hor-*
90	ⲥⲏⲃⲉ	*sebe,*
91	ⲉϥⲧⲉ	*the son*
92	ⲛ	*of the*
93	ϫⲣⲟ ⲡⲉ	*heavenly*

I. Scarabaeus.

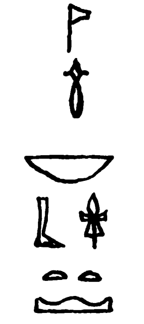
1	ⲤⲞⲨⲦⲚ	*The governor*
2	ϢⲖⲞⲖ	*of the people,*
3	ⲚⲎⲂ	*the lord*
4	ⲦⲎⲚⲈⲦⲞ	*of both the countries,*
5	ⲣⲁⲛ	*namely*
6	ⲞⲨⲣⲞ	*the king*
7	ⲂⲰϪ	*crushing,*
8	ⲘⲀϢⲒ	*justifying,*
9	ⲤⲞⲦⲠ	*the selected*
10	Ⲛ	*of*
11	ⲀⲘⲞⲨⲚ	*Amun,*
12	ⲦⲎⲔ-ⲈϤ	*the strong one,*
13	ⲂⲰϪ	*the crusher*
14	ⲐⲞⲂⲈ	*of the wicked,*
15	ⲂⲞⲖ	*illustrating*
16	ⲤⲞⲨⲦⲚ-Ⲥ	*the kingdom*



114	ΟΥΟΝ ΕΝΕϨ	of eternity
115	ϢΟΠΙ ΠΕ	the future;
116	ϢΟΠ	who made
117	Ν	the
118	ϹΑΒΕ ΜΗϢΕ	man
119	Μ	of
120	ϨΤΟΡ	god, (who is)
121	ϬΟΛ	the creator
122	ΤΟΤΟ ΚΑΠ	of the world,
123	ΑΝϦ-ΕϤ	living
124	ϨΜ	in
125	ϢΩΛΜ	the odorous
126	ΜΑΙ	regions,
127	Μ ϬΛΟΙ	in the gardens
128	ϢΩϢΕΝ	of lilies
129	ϹΩΒΕ.	smiling.
130	ϪΕΤ	He speaks
131	ΤΑΙ ΤΑΙ	thus:
132	ΑΙ	I am
133	Ι	I

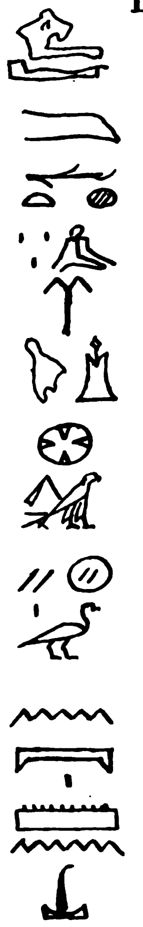


134	ⲟⲩϣϩⲣⲱ	*the most holy one,*
135	ⲚⲈ	*having entered*
136	ⲚⲈⲀⲦ-ⲞⲨⲒ ϪⲢⲞ	*the boundaries of the heavens,*
137	Ⲙ	*the*
138	ϢⲒϢⲒ ⲘⲎϢ	*Potencies mighty,*
139	ϪⲰⲘ ⲠⲈ	*the chief*
140	ⲘⲎϢ ⲠⲈ	*mighty*
141	ϨⲈⲘⲒ	*commanding*
142	ϢⲈⲦ ϢⲞⲦ	*the Crethi*
143	ⲘⲎϢ ⲠⲈ	*the mighty*
144	Ⲙ	*of the*
145	ϨⲦⲞⲢ	*King*
146	ⲔⲎⲘⲈ ϨⲀⲘ	*of the Egyptians*
147	ⲘⲎϢ-ⲞⲨⲒ	*the mighty*
148	ϨⲘ	*at*
149	ⲰⲚ ⲂⲀⲔⲒ	*Heliopolis (Thebes),*
150	ⲚⲎⲂ	*the capital*
151	ϨⲦⲞⲢ	*of the King*
152	ⲔⲎⲘⲈ ϨⲀⲘ	*of Egypt*
153	ⲘⲎϢ ⲠⲈ	*the mighty*

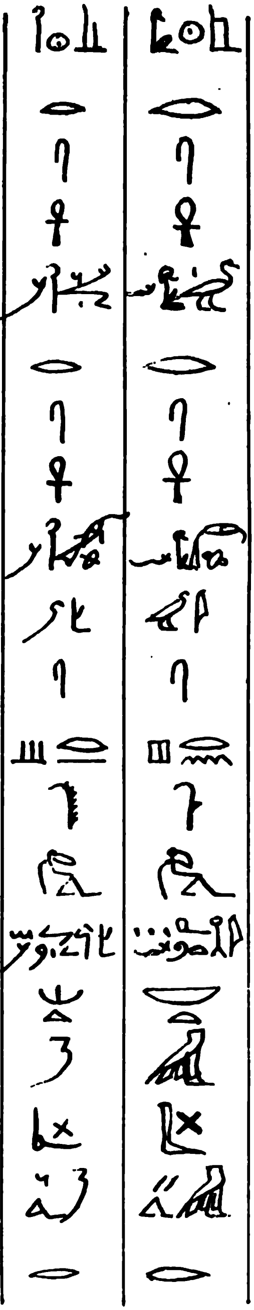


8	ϩⲧⲟⲣ	*the powerful*
9	ⲚⲞⲨⲦⲈ	*godhead,*
10	ⲚⲎⲂ	*the ruler*
11	ϩⲟⲂ	*of the work*
12	ⲐⲞⲐⲞⲔⲀⲠ	*of the worlds.*

IV. Above the soul.

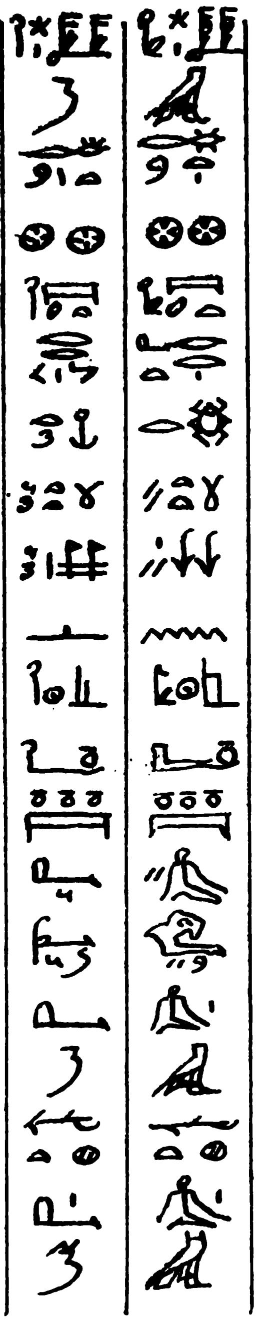


1	ϭⲞⲘ	*The chief*
2	Ⲙ	*of the*
3	ϣⲈⲦϣⲞⲦ	*Crethi*
4	ⲘⲎϣ_ⲞⲨⲒ	*mighty*
5	ϩⲘ	*at*
6	ⲰⲚ	*On (Diospolis, Thebes)*
7	ⲂⲀⲔⲒ	*the city,*
8	ϩⲱⲣ	*Hor-sebe*
9	ⲤⲎⲂⲈ	*(the sword of Horus),*
10	ⲂⲞⲦⲈ ⲠⲈ	*the son*
11	Ⲛ	*of*
12	ϫⲟⲣ ⲠⲈ	*the heavenly*
13	ⲘⲀⲚ	*herds-*
14	ⲘⲞⲞⲚⲈ	*man (the late)*



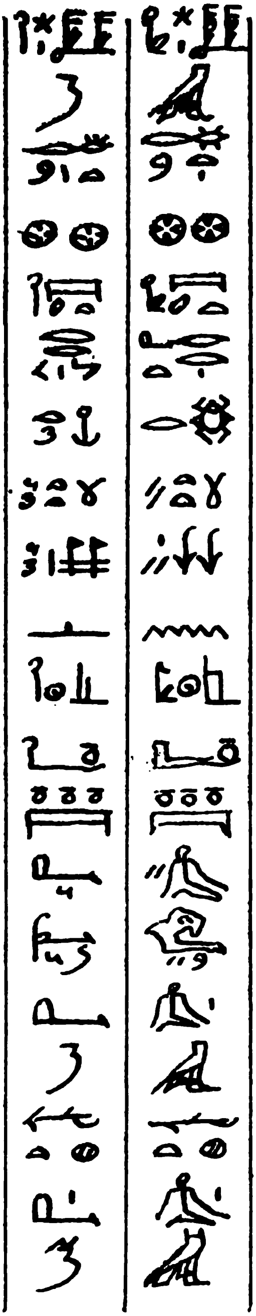
14	ⲱϣ ϩⲣⲱ	*Osiris, (the Sun),*
15	ⲉⲣ	*the ori-*
16	ϣⲟⲡ	*ginator*
17	ⲁⲛϧ	*of the life*
18	ⲃⲱⲧⲉ-ϥ	*of his race,*
19	ⲉⲣ	*the ori-*
20	ϣⲟⲡ	*ginator*
21	ⲁⲛϧ	*of the life*
22	ϣⲗⲟⲗ-ϥ	*of his nation,*
23	ⲁⲩⲱ	*and*
24	ϣⲟⲡ	*the originator*
25	ⲣⲁⲛⲡⲓ	*of the circle*
26	ⲁⲃⲟⲧ	*of the year*
27	ϩⲣⲁ	*of the sun (and)*
28	ⲉϩⲟⲟⲩ-ⲉϥ	*its seasons,*
29	ⲛⲟⲩⲃⲧ	*the builder*
30	ⲙ	*of the*
31	ϭⲗⲟⲗ ϥⲧⲉ	*victims (quadrupeds)*
32	ⲙⲁⲧⲉ	*being convenient*
33	ⲉⲣⲟ	*for*

34	ⲟⲩⲟⲧ	honoring
35	ⲙⲟ-ϥ	him (and)
36	ϭⲟⲓⲗⲉ.ⲁϩⲓ-ϥ ϩⲁⲙ	his house of light,
37	ϩⲱⲛ	(and) ordered
38	ⲁⲧⲟⲟⲩⲉ-ϥ	by his father,
39	ⲟⲩⲣⲟ-ϩⲣⲱ ϩⲁⲙ	the Lord governor;
40	ⲁⲩⲱ	and also
41	ϣⲟⲡ	the originator
42	ϣⲟⲧϩⲁⲙ	of the priests
43	ⲃⲱⲧⲉ-ϥ	for his race
44	ϩⲙ	in the
45	ⲧⲁϫⲣⲟ	firmament,
46	ⲙ	(and) for
47	אדן ⲟⲩⲣⲟ	Adon, the Lord;
48	ⲛ	(who made) the
49	ⲙⲏⲛⲓⲛⲉϩⲁⲙ	Moon,
50	ⲉⲣⲉ	the builder
51	פשתא	of the flax seed,
52	ϣⲗⲟⲗ	(and) her sex
53	ⲙ	of the

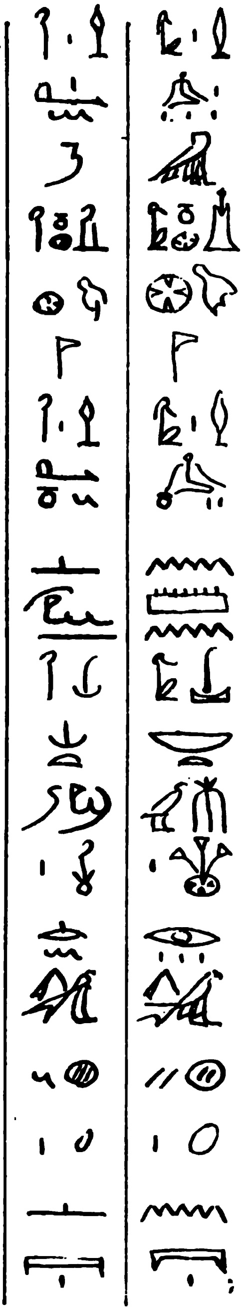


54	ϩⲁⲗⲕ ⲥⲁⲧⲉϩⲓⲙⲉ	spinners & weavers
55	ⲙ	in behalf of
56	Χⲣⲟⲧⲓ	the races
57	ⲂⲀⲔⲒ ⲂⲀⲔⲒ	in both regions
58	ϫⲣⲟϩⲓⲙⲉ	under the heavens,
59	ϩⲣ ⲣⲏⲧⲉ	and also
60	ⲧⲣⲉ	of the makers
61	ϫⲟⲗϩ	of cloths
62	ϫⲱⲙ	for the people;
63	ⲛ	(who made) the
64	ⲟⲩϣ ϩⲣⲱ,	most holy one,
65	ⲚⲀ	the citizen
66	ⲛⲉⲁⲧ ⲟⲩⲓ ϭⲣⲟ	of heavens
67	ⲙⲏϣ	the mighty,
68	ϭⲟⲙ ⲡⲉ	the chief,
69	ⲙⲏϣ	the mighty
70	ⲙ̇	of
71	ϣⲟⲧϣⲉⲧ	the Crethi
72	ⲙⲏϣ ⲡⲉ	mighty
73	ⲙ	of.

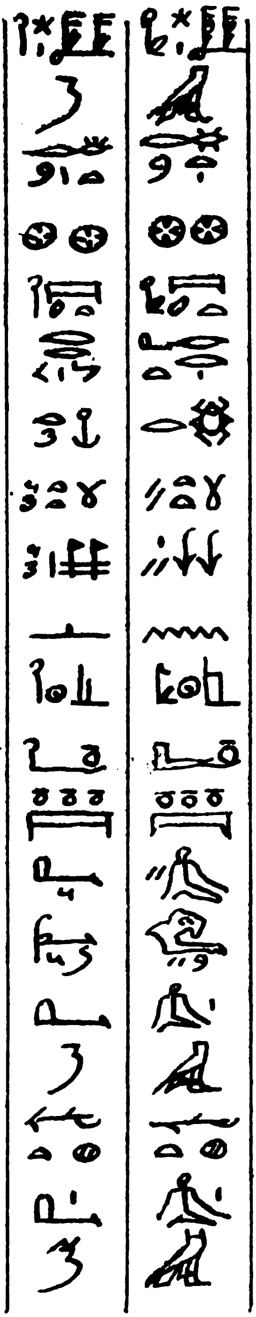
34	ουοτ	*honoring*
35	μο-ϥ	*him (and)*
36	ϭοιλε.ϩϩι-ϥ ϩαμ	*his house of light,*
37	ϩων	*(and) ordered*
38	ατοουε-ϥ	*by his father,*
39	ουρο-ϩρω ϩαμ	*the Lord governor;*
40	αυω	*and also*
41	ϣοπ	*the originator*
42	ϣοτϩαμ	*of the priests*
43	βωτε-ϥ	*for his race*
44	ϩμ	*in the*
45	ταϫρο	*firmament,*
46	μ	*(and) for*
47	אדן ουρο	*Adon, the Lord;*
48	ν	*(who made) the*
49	μηνιπε ϩαμ	*Moon,*
50	ερε	*the builder*
51	פשׁ תּא	*of the flax seed,*
52	ϣλολ	*(and) her sex*
53	μ	*of the*



54	ϩⲁⲗⲕ ⲥⲁⲧⲉ ϩⲓⲙⲉ	spinners & weavers
55	ⲙ	in behalf of
56	Χⲣⲟⲧⲓ	the races
57	ⲂⲀⲔⲒ ⲂⲀⲔⲒ	in both regions
58	ϫⲣⲟ ϩⲓⲙⲉ	under the heavens,
59	ⲉⲣ ⲣⲏⲧⲉ	and also
60	ⲧⲣⲉ	of the makers
61	ϫⲟⲗϩ	of cloths
62	ϫⲱⲙ	for the people;
63	ⲛ	(who made) the
64	ⲟⲩϣ ϩⲣⲱ	most holy one,
65	ⲛⲁ	the citizen
66	ⲛⲉⲁⲧ ⲟⲩⲓ ϭⲣⲟ	of heavens
67	ⲙⲏϣ	the mighty,
68	ϭⲟⲙ ⲡⲉ	the chief,
69	ⲙⲏϣ	the mighty
70	ⲙ	of
71	ϣⲟⲧϣⲉⲧ	the Crethi
72	ⲙⲏϣ ⲡⲉ	mighty
73	ⲙ	of

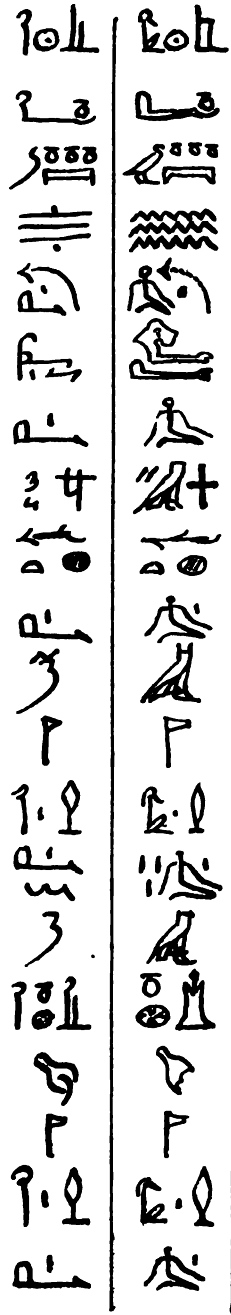


74	ⲔⲎⲘⲈⲠⲈϨⲀⲘ	*the Egyptians*
75	ⲘⲎϢ ⲠⲈ ⲞⲨⲒ	*the mighty*
76	ϨⲘ	*in*
77	ⲰⲚ ⲂⲀⲔⲒ	*the city of the Sun,*
78	ⲚⲎⲂ ⲂⲀⲔⲒ	*the capital city*
79	ϨⲦⲞⲢ	*of the sovereign*
80	ⲔⲎⲘⲈⲠⲈϨⲀⲘ	*of Egypts*
81	ⲘⲎϢ 2 Ⲛ	*mighty both,*
82	Ⲛ	*the*
83	ⲘⲀⲚ	*shepherd -*
84	ⲘⲞⲚⲈ ϨⲀⲘ	*man,*
85	ⲚⲒⲂⲈⲚ	*of all*
86	ⲘⲀⲤ.ⲞⲨⲒ	*being born*
87	ⲔⲎⲘⲈ ⲂⲀⲔⲒ	*in Egypt (and)*
88	ⲂⲞⲖ ⲞⲨⲒ	*vicinities (namely),*
89	ϨⲰⲢ	*Hor -*
90	ⲤⲎⲂⲈ	*sebe,*
91	ⲈϤⲦⲈ	*the son*
92	Ⲛ	*of the*
93	ϪⲢⲞ ⲠⲈ	*-heavenly*



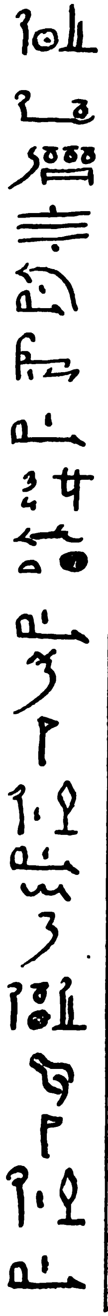
54	ϩⲁⲗⲕ ⲥⲁⲧⲉ ϩⲓⲙⲉ	'spinners & weavers
55	ⲙ	in behalf of
56	Ⲭⲣⲟⲧⲓ	the races
57	ⲃⲁⲕⲓ ⲃⲁⲕⲓ	in both regions
58	ϫⲣⲟ ϩⲓⲙⲉ	under the heavens,
59	ⲉⲣ ⲣⲏⲧⲉ	and also
60	ⲧⲣⲉ	of the makers
61	ϫⲟⲗϩ	of cloths
62	ϫⲱⲙ	for the people;
63	ⲛ	(who made) the
64	ⲟⲩϣϩⲣⲱ,	most holy one,
65	ⲛⲁ	the citizen
66	ⲛⲉⲁⲧ ⲟⲩⲓ ϭⲣⲟ	of heavens
67	ⲙⲏϣ	the mighty,
68	ϭⲟⲙ ⲡⲉ	the chief,
69	ⲙⲏϣ	the mighty
70	ⲙ	of
71	ϣⲟⲧϣⲉⲧ	the Crethi
72	ⲙⲏϣ ⲡⲉ	mighty
73	ⲙ	of

114			ⲟⲩⲟⲛ ⲉⲛⲉϩ	*of eternity*
115			ϣⲟⲡⲡⲓ ⲡⲉ	*the future;*
116			ϣⲟⲡ	*who made*
117			ⲛ	*the*
118			ⲥⲁⲃⲉ ⲙⲏϣ[illegible]	*man*
119			ⲙ	*of*
120			ϩⲧⲟⲣ	*god, (who is)*
121			ϭⲟⲗ	*the creator*
122			ⲧⲟⲧⲟ ⲕⲁⲡ	*of the world,*
123			ⲁⲛϧ-ⲉϥ	*living*
124			ϩⲙ	*in*
125			ϣⲱⲗⲙ	*the odorous*
126			ⲙⲁⲓ	*regions,*
127			ⲙ ϭⲗⲟⲓ	*in the gardens*
128			ϣⲱϣⲉⲛ	*of lilies*
129			ⲥⲱⲃⲉ .	*smiling.*
130			ϫⲉⲧ	*He speaks*
131			ⲧⲁⲓ ⲧⲁⲓ	*thus:*
132			ⲁⲓ	*I am*
133			L	*I*

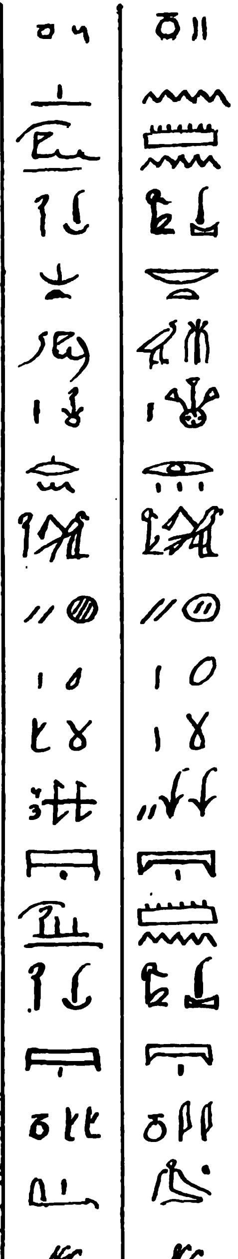


134			ⲟⲩϣϩⲣⲱ	*the most holy one,*
135			ⲛⲉ	*having entered*
136			ⲛⲉⲁⲧ-ⲟⲩⲓ ϫⲣⲟ	*the boundaries of the heavens,*
137			ⲙ	*the*
138			ϣⲓϣⲓ ⲙⲏϣ	*Potencies mighty,*
139			ϫⲱⲙ ⲡⲉ	*the chief*
140			ⲙⲏϣ ⲡⲉ	*mighty*
141			ϩⲉⲙⲓ	*commanding*
142			ϣⲉⲧ ϣⲟⲧ	*the Crethi*
143			ⲙⲏϣ ⲡⲉ	*the mighty*
144			ⲙ	*of the*
145			ϩⲧⲟⲣ	*King*
146			ⲕⲏⲙⲉ ϩⲁⲙ	*of the Egyptians*
147			ⲙⲏϣ-ⲟⲩⲓ	*the mighty*
148			ϩⲙ	*at*
149			ⲱⲛ ⲃⲁⲕⲓ	*Heliopolis (Thebes),*
150			ⲛⲏⲃ	*the capital*
151			ϩⲧⲟⲣ	*of the King*
152			ⲕⲏⲙⲉ ϩⲁⲙ	*of Egypt*
153			ⲙⲏϣ ⲡⲉ	*the mighty*

114	ⲟⲩⲟⲛ ⲉⲛⲉϩ	*of eternity*
115	ϣⲟⲡⲓ ⲡⲉ	*the future;*
116	ϣⲟⲡ	*who made*
117	ⲛ	*the*
118	ⲥⲁⲃⲉ ⲙⲏϣⲏⲉ	*man*
119	ⲙ	*of*
120	ϩⲧⲟⲣ	*god, (who is)*
121	ϭⲟⲗ	*the creator*
122	ⲧⲟⲧⲟ ⲕⲁⲡ	*of the world,*
123	ⲁⲛϧ-ⲉϥ	*living*
124	ϩⲙ	*in*
125	ϣⲱⲗⲙ	*the odorous*
126	ⲙⲁⲓ	*regions,*
127	ⲙ ϭⲗⲟⲓ	*in the gardens*
128	ϣⲱϣⲉⲛ	*of lilies*
129	ⲥⲱⲃⲉ.	*smiling.*
130	ϫⲉⲧ	*He speaks*
131	ⲧⲁⲓ ⲧⲁⲓ	*thus:*
132	ⲁⲓ	*I am*
133	ⲓ	*I*



134	ⲟⲩϣϩⲣⲱ	the most holy one,
135	ⲚⲈ	having entered
136	ⲚⲈⲀⲦ-ⲞⲨⲒ ϪⲢⲞ	the boundaries of the heavens,
137	Ⲙ	the
138	ϢⲒϢⲒ ⲘⲎϢ	Potencies mighty,
139	ϪⲰⲘ ⲠⲈ	the chief
140	ⲘⲎϢ ⲠⲈ	mighty
141	ϨⲈⲘⲒ	commanding
142	ϢⲈⲦ ϢⲞⲦ	the Crethi
143	ⲘⲎϢ ⲠⲈ	the mighty
144	Ⲙ	of the
145	ϨⲦⲞⲢ	King
146	ⲔⲎⲘⲈ ϨⲀⲘ	of the Egyptians
147	ⲘⲎϢ-ⲞⲨⲒ	the mighty
148	ϨⲘ	at
149	ⲰⲚ ⲂⲀⲔⲒ	Heliopolis (Thebes),
150	ⲚⲎⲂ	the capital
151	ϨⲦⲞⲢ	of the King
152	ⲔⲎⲘⲈ ϨⲀⲘ	of Egypt
153	ⲘⲎϢ ⲠⲈ	the mighty



154	Ν·2	*both,*
155	Ν.	*of*
156	ΜΕΝ	*the herds-*
157	ΜΟΝΕϩΑΜ	*man*
158	ΝΗΒ	*of all*
159	ΜΑϹΟΥ	*being born*
160	ΚΗΜΕΒΑΚΙ	*in Egypt*
161	ΒΟλ ΟΥΙ	*(and) vicinities:*
162	ϩωρ ϩΑΜ	*Hor-*
163	ϹΗΒΕ	*sebe,*
164	ΕϤΤΕΠΕ	*the son*
165	ϭΑλΕ	*of the commisioner*
166	ϪΜΕ	*of grains,*
167	ϭρο	*the heavenly*
168	ΜΟΝ-	*herds-*
169	ΜΕΝ ϩΑΜ	*man (apotheosed),*
170	ϭορ	*Zor-*
171	ΕΙΝΕ	*ine*
172	ΜΗϢ ΠΕ	*the mighty one.*
	&c.	&c.

TRANSACTIONS

OF THE

ACADEMY OF SCIENCE OF ST. LOUIS.

A REMARKABLE PAPYRUS-SCROLL, *written in the Hieratic character about* 1050 *B. C., illustrated by* G. SEYFFARTH, *A.M., Ph.D., D.D., Prof. in the Concordia College, St. Louis, Mo.*

GEORGE A. STONE, Esq., of Roxbury, Mass., while traveling in Egypt, acquired a Papyrus, found on the body of a Mummy in one of the Rock Tombs in the hill called "Shik-abd-el-Gourna" at Thebes, in October, 1858; of which he was so kind as to send me an excellent photograph. This Papyrus, nearly five feet long, and ten inches wide, contains the finest Hieratic inscription I have ever seen, and is divided into five columns. The first column represents Osiris, and the soul of the deceased standing before him; on the last column the usual judgment of the dead is depicted. There is Osiris in the background of the celestial court, sitting upon his throne above an estrade expressing the word "justice," while Isis stands behind him. Opposite Osiris appears the soul of the deceased, the likenesses of the four seasons, or Horæ of the year, placed upon the hieroglyphic figure "Egypt," and also Cerberus upon a temple, expressing the word "religion," in order to testify to the piety and righteousness of the man. Behind him Horus and Anubis are to be seen, balancing his good and evil deeds against each other in a pair of scales; the first being expressed by an ostrich feather, i. e., *mashi* (justice); the other by a goose, i. e., *bote* (badness). The result is recorded by Thoth standing on the other side of the judgment-hall. The rest of the Papyrus contains a religious book of the ancient Egyptians, which is wanting in the large collection of the sacred Egyptian records at Turin, in the so-called "Todtenbuch," 57 feet in length, and written in the time of Romulus.* The title and first words of the chapters of this new sacred book are, as usual, written in red ink.

Mr. Stone is also in possession of "a gold spread-eagle taken from the same Mummy-case," which proves that the deceased must have belonged to the most distinguished persons of his age.

Further, "a Scarabæus of white stone, very hard, about 2.5 inches long, and 2 inches wide, the seal of the deceased, was found in the same tomb," of which also Mr. Stone sent me a copy. It contains the following inscription—see Plate XIX., No. 1:

"The governor of the people, the lord of both the countries, namely: the king crushing and justifying, the selected of Amun, the strong one, the crusher of the wicked, the illuminator of the whole kingdom, the offspring of the Lord, the master of the lands, namely: The beloved of Amun, the splendent; Shishank, the fervid, the deliverer of life, the crusher of all malefactors."

From this seal we learn that the deceased was once in the service of the king Shishak, the first of the XXII. Dynasty, about the year 1050 B. C.; for the Egyptian monuments mention two different kings, called Shishak, Shishank, Sesonchosis, of whom the younger one took Jerusalem in the fifth year of Rehoboam (1 Kings xi. 40); i. e., in 945 B. C.† As then, according to Manetho, Shishak I. reigned 124 years before Shishak II., in 945 B. C., it is obvious that the deceased being decorated, like Joseph, with the seal of his king, Shishak I., must have lived about 1050 B. C.; consequently, he was a contemporary of the kings Saul and David. It is on account of this early age that this Papyrus-scroll contains so excellent and careful a handwriting.

Further, in the "same tomb, on the body of the deceased, a Tablet was found, representing the said king upon his war-chariot with two horses and a groom," accompanied by the following inscription—see Plate XIX., No. 2:

"The companion of the king of the people, bruising the world, the donor of life to the oppressed, the punisher of those who were bruising the world."

From this inscription we learn what was the business of the deceased, the companion of his king. For, as Shishak I., the head of a new dynasty, had slain the last king of the XXI. Dyn., and, like the kings in Israel, destroyed his relations and partisans, rebelling in different provinces, by force

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* See Transactions of the Academy of Science of St. Louis, Vol. I., p. 262.

† Transactions of the Academy of Science at St. Louis, Vol. I., p. 265.

of arms, the deceased must have been the companion of the king in his expeditions against the Egyptian rebels.

All these objects, the Papyrus inclusive, for which Mr. Stone paid £90 stg., were found, in 1858, in the same tomb by one of the Theban mountaineers, who stated "that he had never seen a Mummy so carefully and perfectly preserved; that it was covered with linen of a texture nearly as fine as silk; that the head of the Mummy was covered by a mask, painted and gilded: and in the upper room of the Tomb discovered in 1857, stood four jars [*canopi*] of oriental alabaster, with figure heads, the whole covered with hieroglyphics, and enclosed in a box of hard yellow wood, also covered with inscriptions. The jars and the box were sold to Lord Henry Scott, a young Englishman, and they are probably in his possession. The Mask he sold to a Copt who collected and sold antiquities at Thebes, and the Copt transferred it to the French Consular Agent at that place; and it is either in his possession, or in the French Museum at Paris. The Tablet was tied around the neck of the Mummy by a string; the Scarabæus lay on the breast, and the Eagle and Asp were nailed on the top of the Mummy-case."

Now, what may be the contents of this very remarkable Papyrus-scroll? Mr. Stone, as he wrote me, sent copies to "several persons in New-York, who attempted the translation, but failed;" probably because they were acquainted only with the system of Champollion, according to which nobody, as yet, has succeeded in translating one line of a hieroglyphic, or Hieratic text, down to this day, as is known.

Above the head of Osiris, in the first section, we find the following inscription—see Plate XIX., No. 3:

"This is the likeness of Osiris, the powerful, the prince of the fullness of the earth in both the worlds, the mighty godhead, the ruler of the work of both the worlds."

Above the picture of the deceased the following is written, also in the hieroglyphic character—see Plate XIX., No. 4:

"The chief of the Crethi (the royal life-guard) in the city of the Sun (i. e., Diospolis or Thebes): Hor-sebe (i. e., the sword of Horus), the son of the heavenly herdsman (i. e., being united with God) Zor-ine, the thrice mighty."

Behind the same picture the following hieroglyphic inscription is written—see Plate XIX., No. 5:

"The celestial (i. e., the apotheosed), the divine flame, the radiant Sun, the head of the formidable Crethi, the sword of vengeance, whose life was this: he has crushed the wicked; crushed the head of the trespassers on what was holy, in the boundaries of the state of On (Thebes); cut up the perpetrators of wrong in the province of (the god) Tore; commanded the Crethi, the warriors, in the province of the supreme government (Thebes); pierced the malefactors in the province of the god Thamus; slaughtered the murderers of the inhabitants in the province of the beneficent goddesses Meni and Oni, viz: Hor-sebe, the son of the heavenly herdsman, Zorine, the thrice mighty."

The second column of the Papyrus contains the introduction and the beginning of the sacred book itself, written in the Hieratic character, of which the following is a translation —see Plate XIX., No. 6:

"The Book of Hymns for singing the glories of him who made the Isis (the earth), (the glories) of that invisible being who made Osiris (the sun), the originator of the life of his race, the originator of the life of his nation, and the originator of the circle of the solar year with its seasons; the builder of the sacrificial quadrupeds, being convenient for him in his house of light, and ordered by his father, the lord governor; the originator of the priests for his race in the firmament, (and) for Adon, the Lord; (who made) the Meni (the moon), the originator of the flaxseed, of her own sex, and of the spinners and weavers for the races in both the regions of Egypt, and also of the makers of cloths for the people; (who made) the most holy one, the apotheosed mighty chief of the Crethi, the warriors of the mighty Egyptians, those in the city of the Sun (Thebes), the capital of the sovereign of both the mighty Egypts, of the shepherd of all born in Egypt and its vicinities, (viz.) Horsebe, the son of the heavenly herdsman (i. e., the apotheosed) Zorine, the mighty.

"Praise, praise, praise him who built this powerful eminent creature, this cutting sword, for prudence thine; who also raised myself, who made the men, the powerful, the lords of future eternity; who made that man of God; (praise him) the creator of both the worlds, who is living in the odorous regions, in the gardens of smiling lilies.

"He (the deceased) speaks thus: I am myself the most holy one, having entered the boundaries of the heavens, the mighty potencies (the celestial powers—viz., I) the mighty chief of the mighty Crethi of the king of the mighty Egyptians in the city of On, the capital of the king of both the mighty Egypts, the shepherd of all born in Egypt and its vicinities, (viz.) Horsebe, the son of the commissioner of the grains, the heavenly herdsman (the apotheosed) Zorine," and so forth.

ANNOTATIONS.

The Egyptian coloring of these texts will not surprise any one who is acquainted with oriental writings. As to the hieroglyphic figures occurring in those specimens, they have all been explained *in extenso*, both syllabically and alphabetically, in my Grammatica Ægyptiaca, Leipsic, 1855.

The system of Champollion, according to which no hieroglyphic figure expressed a syllable, is, as it seems, refuted also by a fact reported in Dr. Livingstone's Travels in Africa; for it is known that, according to Biblical traditions, all the inhabitants of that country are descended from Ham; and from the Egyptians and from the Classics we learn that the first colony coming out of central Asia was that of Menes (Mizraim) in 2780 B. C., 666 years after the deluge.* Prof. Pott of Halle, in his large learned work concerning all the languages of Africa, has demonstrated that all, except two or three spoken on the coasts, are related the one with the other as sisters, and particularly with the Coptic language, spoken in Egypt since the time of Menes (2781 B. C.) As then, according to Biblical history, the whole of Africa was colonized by the Egyptians since Menes, it is probable that all the tribes going out of Egypt carried the same arts and sciences with them into their own countries, particularly the same method of expressing their ideas by figures. Now, Dr. Livingstone relates that he met, in central Africa, with a colony in an extraordinary degree civilized and learned, which used but syllabic signs in order to express words. "The people of Bermegai," he says, "have a written language. Their alphabet, if we may so call it, consists of about two hundred and eighty letters or characters, each character representing an entire syllable; and these, variously combined, constitute all the words in the language. Many of their words bear a striking resemblance to Hebrew words of the same signification."† This fact, I think, is a new confirmation of my hieroglyphic system, and a new confutation of Champollion's.

As regards the hieroglyphic groups and words contained in those specimens, a great many of them occur in the inscription of Rosetta, on the Obelisk translated by Hermapion, and in the other bilingual inscriptions, or in the whole fifteen texts explained in my "Theologische Schriften der alten Ægypter, Leipsic, 1855," where they have been already deciphered, reduced to Coptic roots, and translated. A few words were quite new to me, although my Dictionary contains nearly six thousand articles; wherefore the question is, whether they are correctly translated or not. As, however, they must recur in other places and in other connections, the future may confirm, or correct, some particulars in my translation.

I. The Scarabæus.

1. The flax-stalk is translated in the Rosettana by *king*, in Coptic *suten*, and stands very often, in different copies of

* See my Berichtigungen der alten Geschichte und Zeitrechnung, auf Grund neuer histor. u. astronom. Hülfsm. Leips. 1855.

† Dr. Livingstone's Seventeen Years' Explorations, etc. Philadelphia, 1858. p. 228.

the same text, for the three letters: flax-stalk (*s*), mount (*t*), and waves (*n*). Its name in the modern Coptic, is *shento*; in the ancient or "sacred dialect," *satin*, like the Hebrew. Consequently the flax-stalk alone contained in its name the consonants *stn*, and expressed them syllabically in many Egyptian texts. The subsequent mount, which commonly follows all syllabic figures, as I have demonstrated in my Grammatica Ægyptiaca, signifies that the preceding hieroglyph pronounces syllabically. Thus, then, the word *suten* (king) was expressed in Egypt by the figure of a flax-stalk, because its name contained the same consonants which are contained in the word *suten* (king), as the Rosettana translates. According to Champollion this same flax-stalk sounds *s*, and is an abbreviation of the word *suten;* a practical system, which obliges the hieroglyphist to take a single *s* for five letters, for the word *suten;* then, why not also for *sat* (mist), or *sat* (the seed), or *saat* (to leave), or *set* (a saviour), or *sit* (a snake), or *soit* (glory), or *sti* (perfume), or *sote* (the arrow), or *stati* (the steel), or *sotep* (the elector), or *sotf* (pure), or *sosh* (a joke), and so on? What brain would be capable of translating correctly a hieroglyphic inscription, consisting of 100 words, of which, as usual, 80 express abbreviated words of that kind.

2. The wasp signifies, according to Horapollo, the obedient people; and, indeed, *shal uki* (the wasp) contains the same consonants that are in the word *shol*, or *shlol* (people). What reason there was for expressing the idea, people, symbolically by a wasp, Champollion never explained.

3. The vessel, including the royal name, is not at all a symbolic sign for the word "name," in Coptic *ran*, but the vessel was called *ran*, and therefore it expressed syllabically the word *ran* (the name), because both contained the same consonants. It is true, the word *ran* (vessel) is wanting in our Coptic Dictionaries; they offer, however, the word *me-ran*, (water-vessel), and in the Hebrew we find the word *aron* (vessel, shrine); while the Coptic *me* signifies water.

7. The fox, in the modern Coptic *bashur* and *bashi*, was, in the old Coptic, pronounced *bakur* and *baki*, because it expresses in many monuments the name of the king *Bokar* (Bokharis), and since *k* commonly changes into *sh*. For the same reason the fox expresses the word *bek* (crushing), as is the case in IV., 17. In the latter place this same word *bek* is expressed by the whip, which is there the phonetic determinative of the fox, viz., *bk*. According to Champollion's Symbolical theory, our king was the "*gardien de la vérité*."

13, 14. The sparrow-hawk signifies, according to Champollion, a sparrow-hawk, and the stone, a stone; consequently, king Shishak was at that time a sparrow-hawk of the stones, or rather—as the hawk tropically signified also, by means of a *quid pro quo*, a king—the king of the stones. Fortunately, however, the same words occur in IV., 15, where the whip (*wosh*, in the ancient Coptic *bok*) again signifies the word *bek* (crushing). As, then, the sparrow-hawk was also called *bek*, it expressed syllabically that same word *bek* (crushing), while the stone (*tob*) syllabically expressed the word *thobe* (wicked). Thus, then, our king was simply "the crusher of the wicked; or, according to Champollion, "the guide of the stones."

18. The goose *opt* does not at all, as Champollion imagined, signify the Coptic word *she* (son); it sounds syllabically *bote* (germen, offspring); as, e. g., the said judgment of the dead proves. For, we have seen, that, there, the righteousness (*mashi*) of the deceased was expressed by the ostrich feather (*mashi*), and his badness, on the other scale, by the goose (*opt*) representing syllabically the word *bote* (badness). Probably, however, according to Champollion, our good geese were once very bad.

24. The figure mount is not very clear in the copy sent me by Mr. Stone, and therefore my translation may not be reliable.

28. The eye expresses not only the *a*, and *e*, and *i*, and the word *iri* (to make), as Champollion discovered, but also, being its vulgar name, *bal* and *bar*, e. g., in *bar-alion*, oculus lyncis, syllabically *bl* and *br*; wherefore it expresses very often the words *bar* (the son), and *bara* (to make). For that reason I refer the group in question to the Coptic words *bar-ef* or *bol-ef* (fervid), and that eye No. 15 to the root *bol* (making illustrious), and the groups VI., 88, 161, to the word *bol-wi* (vicinities). This eye is an inexplicable mystery for Champollion and his partisans.

For the rest, many of the titles given here to king Shishak were stereotyped in Egypt, and were therefore repeated; and they were translated in the Rosettana.

II. The Tablet.

4. This hieroglyph represents, as I have demonstrated in my Grammatica Ægyptiaca, the forehead, in Coptic *tehne*; wherefore it expresses syllabically all words containing the same consonants, particularly here the word *tno* (to bruise), commonly the number 10 (ten), in the modern Coptic *ment*, in the ancient *ten*; and I do not doubt that from a similar aboriginal root our *ten*, the Anglo-saxon *tyn*, the German *zehn*, the Dutch *tien*, are derived, together with the Coptic *ten* (decem). According to Champollion the said front signifies always symbolically the number 10; and so we get the wonderful sense that king Shishak, at that time, was called the figure 10 of the mount.

9. The hatchet always signifies, according to Champollion,

viz., symbolically, a god; but he never demonstrated what rational affinity existed between a god and the axe of a butcher. In the mean time we find that the same word god is alphabetically expressed, in different copies of the same text, by three figures, viz., the hatchet (*h*), the mount (*t*), and the waves (*n*), which gives the word *hater* (hammer, hatchet), and also *htor* (necessitas, arbitrium, potestas); in short, every kind of supremacy. In the Hebrew, the same word *adar* signifies mighty, powerful; and thus every one sees that the "hatchet" here expresses syllabically *htor*, the supremacy of the king Shishak over the bruised rebels; while Champollion gives the nonsense that the king was the god of the enemies which he had killed before.

IV. Above the Soul.

1. The lion's claw, in the modern Coptic *dsame*, and corruptly *dsadsme*, in the ancient sacred dialect *kame*, expresses the same consonants *km* in many words, e. g., in the name of the king P–Samus (P–Kamus), in *Keme* (Egypt), as the Rosettana demonstrates, in *dsom*, kom (force), as Horapollo says, in *koma*, corruptly *shem*, altitudo, summitas, and others. Therefore, it expresses here syllabically *dsom* (the chief), and below *dsome* (the book). How it was possible to signify all these words and proper names symbolically, or, according to the law of abbreviation, by the lion's claw, Champollion and his partisans may explain themselves.

3. The group *shetshot*, the ancient *ketkot*, originated from the root *kot*, *shot*, *shetshot* (to cut, secare), and therefore it corresponds exactly with the Hebrew Crethi, derived from the root *carath* (to cut, secare). Those Crethi, however, as well as the Plethi, represented not the royal life-guard only; they also served as the standing army of David. The same we find in Egypt, where, as Herodotus says, the royal army consisted of two classes, viz., of the Hermotybies and the Calasirii. Thus, the deceased was, while living, the chief of the Egyptian *Crethi*, or *Kotket*, in the residence of the king Shishak at Thebes, On-baki, Heliopolis, Diospolis, about 1050 B. C., in the times of Saul and David.

4. The sitting figure, from the root *hmaas*, *hemsi* (to sit), occurs 17 times in our texts, always expressing the words which contain the same consonants *ms*, or rather *msh* in the ancient Coptic. Sometimes the connexion only decides to what Coptic word the figure is to be referred. According to Champollion, it gives in all places the wonderfully fitting sense "wife."

12, 13, 14. At first I was inclined to take these groups for the name of Horsebe's father, or for his office, which in all funeral Papyri precedes the name. But the same groups obviously express, in VI. 83 and 156, the words shepherd, herdsman; and the father's office precedes, in 165, the groups in question. Further, all funeral Papyri put after the name of deceased persons the words *mashi moshi*, justificatus justus, corresponding with our "blessed," *beatus;* while they are wanting here, and are substituted by the words *na neat tsor* (i. e., one who entered the boundaries of heaven), put before the proper name. Consequently, the groups 12, 13 and 14 must express the idea justus justificatus, or "the late," beatus; and indeed they signify a heavenly herdsman, or, in the first signification, a man who, like the sun and the moon, walks through the starry heavens. That is, according to the Egyptian theology, the souls of the pious were united with the Sun and other deities, and performed with them their heavenly revolutions. The same ideas are, as we have seen, expressed by the groups V., 1, 2; VI., 135, and others, containing the words *na neat dsor*, i. e., being elevated to the heavens, or walking through the celestial fields.

15, 16. The name Zorine probably means the likeness of the heavens; for the firmament is, in the Coptic, called *zro* and *ta-zro*, and *ine* is likeness.

V. Behind the Soul.

3. This vase signifies, in the Rosettana, III., 25, *dsir*, embalm, condire; wherefore, according to the context, it expresses syllabically the word *dsere*, ardor, or the flame of God, the divine ardent sun.

7. The walking-man (*mashi*) stands here for the lion's claw in the same group; wherefore it must express the same idea by another word, viz., *mesh*, the prince, for *dsom*, the chief. Obviously, both the groups state Horsebe to have been the commander of the royal life-guard.

12. This statue (*tob*) signifies, in the Rosettana, the word *tove*, progenitor, originator; and here, as the context requires, syllabically, *tob*, ultor. Champollion's system brings out, "the sword of the Mummy"—of course, symbolically.

18. The same system creates here a new wonder, a king being the "watchman and the leader of the starry heavens."

29. The form *tene*, sounding *tn* in Tentyris, Tenhur, and others, signifies an Egyptian Nomos or province; and it is known that all the Nomi were presided over by different deities, from which their names were derived. According to Champollion, all the rebels, suppressed by our captain, resided in different "chambers" of different gods.

41. From Champollion we learn that our chief of the Crethi was, at the same time, a "priest" in the service of the enemies.

VI. The Hieratic Text.

1. The words *kome em smusui hosen sonsen*—i. e., "The Book of Hymns"—are the title of many similar Egyptian Pa-

pyri, of which two have been published by H. Brugsch in 1851. According to Champollion, however, he spells Nos. 3—6, *sai an sinsin*, and brings out the nonsense, "Liber Metempsychosis." Thus the curious title of the Hymn Book originated: "*Sai an sinsin*, sive Liber Metempsychosis veterum Ægyptiorum e duabus papyris funeralibus, hieraticis signis ex oratis, nunc primum edidit, Latine vertit, notas adjecit H. Brugsch," etc. The lion's claw, according to Brugsch, signifies "beginning," as he translates.

4. The handkerchief, called *kaisi*, and depicted in the hands of a thousand human figures on Egyptian monuments, expresses the syllable *ks* (*kos*) in the word "Graikos" (Greek) upon the Rosetta-stone, and likewise *ks* in many other words; therefore it gives here, determining the word *smusui* (praises), the modern Coptic *hos*, the ancient *kos*—canere, celebrare, laudare. According to Champollion, we see here the figure of an Egyptian penknife, and one of Champollion's symbolic determinatives, indicating "to what class of things the preceding group belonged"; consequently the "praising" belonged, among the sage Egyptians, to the class of "penknives."

10. Isis was not only the goddess of the moon, but (her name being an appellative) also the earth, as Plutarchus (De Osir. et Is., page 366) expressly says "Ægyptii corpus Isidis terram putant."

12. This group signifies, according to Champollion, one thousand gods, or the god of the number 1000, because he ignored that the leaf of the lotus, in Coptic *dsove*, i. e. *kobe*, *kope* in the ancient dialect, expressed the syllable *kp* in *kap* (obscurus); that the following leaf, e. g., *es* or *s*, made the substantive "obscuritas"; that the subsequent figure, *ham*, signified "ens," being, and that the whole translated "ens obscuritatis," invisible being.

18, 19. The author calls Osiris the originator of different classes of human and animal creatures, which is explained by the Egyptian Mythology. For the first sacred book of the Egyptians, translated in my Summary, says expressly that the Cabiri, the planetary gods, "worked for their master, their creator;" that they had coöperated in the work of creation; that each of them had formed specific classes of men, animals, plants, etc.* Thus, e. g., to the *Ducatus* of the Sun belonged the kings, the priests, the good princes, the victors, riches, large cattle, etc., as the ancient Astronomers say.

16. The combed flax, called in the modern Coptic *seppi*, in the ancient *shepe*, expresses the so frequent auxiliary verb *shope* (to make, create), the German *shaff-en*, *shoepf-er*, and occurs in our texts not less than nine times in that very

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* See my Summary of Recent Discoveries, N. Y., 1857, p. 67; Systema Astronomiæ Æg. quadripartitum, Lips., 1833, p. 63.

same signification. Champollion, ignoring the syllabic power of the hieroglyphs, teaches this figure as always sounding *s*, to change all verbs into intransitives. Consequently the next word Osiris, although followed by "the determinative god," was not a substantive, but a verb, and so the following nonsense comes out: "God the creator osiriavit or osiriatus est." This hieroglyph alone, by its frequency, prevents all the followers of Champollion's unsound acrophonic system from translating whole Egyptian texts. Compare VI., 41, 111, 116.

25. The word *ranpe*, in the modern corrupted Coptic *rampe*, from which *rompl* (the year) originates, means, in its first signification, a ring, a circle.

42. The mount with a forest (*shta*) expresses, according to Champollion, a *crown* and also a *feast*, and the subsequent "determinative," the figure of a god, brings out "a god of festivities;" a godhead totally unknown, as yet in our Mythologies. The man, however, in Coptic *ham* (homo), being copulated with the syllable *sht*, i. e. *shot* (sacrifice), gives, "a man of sacrifices, a priest."

47. The word *Adon* is wanting in all Coptic Dictionaries; the context, however, teaches that it signifies the creator of the earth, of the sun and moon. It is obvious that Adon among the ancient Egyptians corresponded with the Hebrew, or rather antediluvian *Adon*, the Adonis of the Phœnicains, the Lord.

49. The crescent, being determined by a man, signifies according to Champollion, the god of the moon. That same crescent, however, expresses in certain Nativities of the king Menes, referring to the year 2780 B. C., the syllable *mor* and this very same name Meni,* from which we learn that the crescent or moon was not at all a symbolic, nor especially a "figurative" figure; but that the moon, in the ancient Coptic, was called *Meni* like the Hebrew *meni*, the Greek *mene* and *mona*, the Gothic *mena*, the Saxon *mona*, the Dutch *maan*, the Danish *maane*, the Swedish *mana*, the Lapponic *mana*, the English *moon*, the German *mond*.

51. The word *pishte* (flax), has also disappeared in the modern Coptic, and is obviously derived from the primitive language, from the Hebrew *pishte* (flax). The annexed figure of the pupil, *hra*, expresses not, as usual, the sun, but the word *her* (seed), because both words contained the same consonants. According to Champollion the flax belonged to "the class of suns or pupils." The author ascribes to the goddess of the Moon the flaxseed, the sex of the spinners and weavers, and the makers of cloths, according to the Egyptian Mythology, which refers the female sex and its labors to

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* See my Berichtigungen der alten Geschichte, p. 199; Summary of Recent Discoveries, p. 98.

the Moon, or Isis, as is to be seen in my Astronomia Ægyptiaca. These opinions must be very old, since even in Germany it was once believed that the flaxseed would prosper best in those years, which, according to the old Calendars, were presided over by the planet Venus, the tutelar goddess of the flax.

54. According to Champollion our Captain was Osiris himself, or rather an "Osirian."

62. This group signifies "le dieu Thothunen," and gives, according to Champollion, the wonderful sense: the makers of the gods Thothunen.

112. This group is translated in the Rosettana by *man*, and probably refers to the Coptic *sabe*, sapiens, because the door-bar expressed the syllable *sb*, and the joined figure of a man (*ham*) explains the whole: ens sapiens, a rational being, the wise. This group is also, together with many thousand similar ones, an inexplicable mystery to the Champollionists.

114. Horapollo I., 34, 35, testifies that the Phœnix expressed the word "longævus," *won eneh*, i. e., living a long time, or eternal; which corresponds with the name of the Phœnix, *benne* or *beno*. The following syllable, *kb*, probably refers to the word *shobe*, the old Coptic *kope* (future) or to the word *shibe*, *kibe* (transmutation); wherefore we may translate, "who created the men, the lords of the future eternity," or "the lords of the eternal permutation." I am not sure whether I have correctly translated these groups, which occur very seldom in Egyptian writings. According to Champollion, the Phœnix signified symbolically the inundation; consequently the Egyptian men were, at that time, the "lords of inundation."

138. The figure of a wound expresses, according to Champollion, symbolically, the idea "pouring out," and gives, being determined by a "wife," the pretty fitting sense that the soul of the defunct had entered the woman of pouring out.

165. The office of Horsebe's father is expressed by the words *dsale* (committere aliquid alicui), and *dsme* (satio); wherefore we translate: commissioner of grains. It is known that the Egyptians were obliged to give the tenth part of all grains grown in the country to the king, and for collecting such tributes certainly different persons in different provinces must have been employed as representatives of the king. The Mummy-case of an officer and royal vice-regent of that kind, born in 1524 B. C., is preserved in the Museum at Leipsic, as I have demonstrated in my Theologische Schriften der alten Ægypter ubersetzt cet., page 229, and my Berichtigungen der alten Geschichte, cet., page 152.

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On this occasion I feel obliged to recur to an article in the "Atlantis, a Register of Literature and Science, conducted by Members of the Catholic University of Ireland," Lond., 1859, No. III., p. 74, being entitled "Seyffarth and Uhlemann on Egyptian Hieroglyphics—by P. Le Page Renouf," which but a few days ago came into my hands.

It is not at all a matter of delight for a learned society to be drawn into literary disputes; sometimes, however, it is a kind of duty for every member of the scientific world to interest himself in such matters, viz: when the common property of the whole human race, which is called truth, happens to be assailed; when falsehoods are spread abroad, preventing others from cultivating the same field of science, or leading them to the propagation of new errors; when the literary property of an individual, sometimes his whole possession in this world, is in danger of being stolen by unclean hands, and of being placed to another's account. Any citizen that has sustained injury as regards property, or honor, can obtain satisfaction by a process of law; but for injured literary men no forum exists; their only refuge is public opinion, and the justice of other truth-loving men.

The intention of the said article, written for "readers who have never made hieroglyphics an object of their special study, and who possess but what is called a literary knowledge of the controversy," is very clear. The first object of the author is to show that Champollion's system with all its particulars is the true key to the whole Egyptian literature; that every one, applying it to a hieroglyphic text, obtains the same words and ideas that the ancient author had in view. His second object is to persuade the "unlearned reader" to believe that my system is "fundamentally unsound, and simply illusory." "The fundamental objection," he says, "to that system consists in the apparent impossibility of learning or teaching it." "This difficulty really seems to be fatal to the entire system." "Surely, spelling like this is either not easily learned, or it is a great deal too easy." "Seyffarth's system is not calculated to give the learner much hope of progress." "If this be the key, it would be a sufficient answer to say that with such an instrument it would be as possible to decipher texts as to open real doors with an ideal key." "Seyffarth's syllabic values of the hieroglyphs can as little be depended upon as the prediction of wind and rain in a sixth-rate weather almanac." "There is no arguing with people who talk such nonsense"; and so forth.

In general, I must acknowledge that the said article is written so ingeniously, skilfully, and winningly, that scarcely one reader, except the author and myself, would suspect its deceptiveness, and that, had I not a conscience, I should wish to be able to write such articles. As, however, my motto is *Suum cuique*—or, Truth for friends and enemies—I can but admire the eminent superiority of the Rev. P. Renouf of Dublin. On the other hand, I can not conceal that his treatise is so full of contradictions, misrepresentations, insinuations, and calumnies, on every page, that a small volume would not suffice to refute them all.

Let us come to the point, and first to the apotheosis of Champollion's system. A hieroglyphic system, we understand, is a complex of rules, according to which the ancient Egyptians are supposed to have expressed their ideas. The system is true in case it enables the student to translate whole texts so as to give the sense intended by the author; and, on the contrary, it is false if it yields nonsense, or, at least, furnishes translations differing from the writer's meaning. In this respect, the touchstones are all those Egyptian inscriptions translated by the ancients, particularly the Rosettana, Hermapion's Obelisk, the Table of Karnak, Manetho's Dynasties at Turin, the Table of Abydos, the Door of Philæ, the Catalogue of the Astronomical Decani, and many minor monuments.

The origin of Champollion's system was as follows:—First, in 1821, he published a pamphlet, "De l'Écriture Hiératique," in which he attempted to prove the hieroglyphic writings to be wholly symbolic (point alphabetique). It would, however, be indiscreet to criticise the different systems which were given up by Champollion himself. As soon as he became acquainted with Young's discovery, according to which all the so-called Cartouches, or oval rings enclosing hieroglyphs, contain royal names, expressed not symbolically, but syllabically and alphabetically, Champollion published his "Lettre à M. Dacier," in which he deciphered many other royal names, and augmented and corrected Young's alphabet. Soon after, in 1824 (2d ed. 1828), he published his "Précis du Système Hiéroglyphique des anciens Egyptiens;" finally, in 1836 to 1844, his large Grammar and Dictionary appeared. In those works the whole system of Champollion, who died in 1832, exhibits itself as follows:

1. The language of the hieroglyphic inscriptions is partly an ideal one, regarding all the symbolic hieroglyphs, partly the Coptic, spoken 3,000 years after Menes, and preserved in the Coptic works of the second and following centuries A. C., and taught in our Coptic Grammars and Dictionaries.

2. One half of every hieroglyphic inscription consists of symbolic figures explicable to everybody's fancy; the other half of mere letters, like all other alphabets.

3. The phonetic hieroglyphs express but one consonant or vowel, viz., that by which the name of the hieroglyphic figure begins, like the Hebrew letters.

4. No hieroglyphic figure expresses a syllable, or two or three consonants.

5. Many hieroglyphic figures are to be taken in one place for ideographic, i. e., figurative, or tropical, or enigmatic signs; in the other, simply for letters, acrophonetically.

6. All inscriptions contain a mass of abbreviated words, e. g., *s* for *suten*, *n* for *nuter*, *o* for *onch*, and so forth.

7. Commonly each group is followed by a determinative, a figure signifying symbolically to what class of things the preceding word or group belonged.

8. Of the 600 hieroglyphic figures of the ancient Egyptians (the Dublin hieroglyphist creates about 500 more, and it would be interesting to see them), the alphabetic value of 232 is determined in Champollion's works; therefore about 400 may have belonged to the symbolic dictionary of the ancient Egyptians.

All these rules, constituting Champollion's system, are based, not upon the translation of the entire inscription of Rosetta, or other whole texts, but upon a number of royal names and single words, which, being separated from the context, are susceptible, according to Champollion's system, of a hundred different translations, as his Grammar and Dictionary demonstrate. It is a great misfortune for Egyptian Philology that Champollion published his system before trying to translate and explain grammatically whole Egyptian texts. Had he done so, he never would have published such a system, and prevented the progress of that science.

As the first object of the Dublin hieroglyphist is to advocate that system, and to demonstrate that it is really the key to the Egyptian literature, every one will expect striking proofs of it in the said article. I, myself, looked for them anxiously, and read the article over twice and thrice, but failed to discover them. The recommendations of Champollion's system amount to the following, only:

"The illustrious Champollion," "the great master," "the orthodox school," "the orthodox mode," "the orthodox theory." These proofs, however, as it seems to me, are not very evident; for although, in the times of Copernicus, every one held Ptolemy's system to be true, it was universally abandoned after Copernicus' heresy had expired in the jail.

Further, says this article, "Champollion has determined the general sense, at least, of a vast number of inscriptions." Although I imagined myself to be acquainted with the whole of the Egyptian literature published since the discovery of the Rosetta-stone, yet I knew nothing of "that vast number of inscriptions, of which the general sense had been made out by Champollion;" and the learned world would be much obliged, should the new Egyptologist of Dublin be so kind as to publish that "vast number of inscriptions."

Moreover, he continues, "Champollion laid the solid foundation of the whole science of Egyptian philology." Why not Dr. Young, who discovered the first articles for all future Egyptian dictionaries, the first grammatical forms, and the first phonetic hieroglyphs? Perhaps, however, the question is of the great improvements on Young's discoveries; and, then, I ask the reader whether a system which, as yet, has not enabled any one in the whole world, and during forty years, to translate and explain correctly a single chapter of an Egyptian text, is to be called "the foundation of the whole science of Egyptian philology"? That is all; and obviously the advocate of Champollion's system has been too economical in the proofs of his first position. Although the testimony of a Rev. Professor of Dublin may have been, perhaps, decisive in the eyes of some of his readers, yet there exist also many people so foolish as to require facts before believing that Champollion's system really is the key to the whole Egyptian literature; and therefore the Rev. Reviewer will excuse the boldness which ventures slightly to enlarge his catalogue for the benefit of his friends.

In 1829, in a confidential moment, Champollion said to me, "we want another Rosetta-stone to enable us to translate whole Egyptian texts"; although he ought to have said—According to my system, it is impossible to translate whole Egyptian texts. At least, this open confession demonstrates that Champollion himself was somewhat more truth-loving than his advocate.

In the London Review, No. CLX., p. 158, we read, "it is one thing to be able to read proper names of kings, another thing to be able to decipher and explain a page of the Todtenbuch (the Turin sacred records)."

Further, "a most learned and accomplished scholar," Mr. G. Long (Egyptian Antiquities in the British Museum., Vol. II., p. 361), "has declared that if the hieroglyphic mode of writing be a complex system, the same text, the same phrase, and perhaps the same word, containing phonetic, symbolical, and figurative elements," as is the case according to Champollion, "no man in his senses will ever trouble himself about deciphering a hieroglyphic text." It is true, the Rev. P. Renouf cites this very same sentence, but adds that the sober Mr. Long is "a person ignorant of mathematics."

Chevalier Bunsen, the warmest friend and illustrator of Champollion's system, from 1822 down to 1845, said, after a hundred fruitless attempts, in his Egypt (Hamb., 1845, Vol. I., p. 320), "we declare, decidedly, that there is not a man alive who could read and explain" (according to Champollion's system) "any whole section of the Book of the Dead, much less a historical Papyrus." The Rev. Reviewer also cites this positive witness, but mutilates it and calls it "rather imprudent;" of course, because Bunsen was about to destroy finally the nimbus of the "orthodox school," and to prevent its members from reforming the system of the "great master" *insensiblement* into the opposite one.

Further, Champollion's successor at Paris, M. de Rougé, says in his explanation of the "Inscription sur le tombeau d'Ahmes, Paris, 1851": "It would have been impossible to translate this inscription according to Champollion's system, in the condition in which he left it;" that is to say, the "impossibility" was surmounted by the aid of my syllabic principle and alphabet, of which he had a copy in hand, as we shall see hereafter.

Furthermore, the able Lepsius says, "there are inscriptions of which, as yet" (according to Champollion's System—his Alphabet, Grammar, and Dictionary), "we understand nothing." This is just my opinion; and why are these men not understood?

Moreover, Champollion was, from 1800 down to 1832, in possession of copies of the Rosetta-stone, and, although challenged by his friends and antagonists to verify his system by a translation of that bilingual inscription, he never succeeded in translating it, except a few groups containing no syllabic hieroglyphs: and why not? The first translation of that touchstone appeared a short time after my syllabic alphabet came into the hands of Mr. Brugsch.

Besides, Champollion was twice in Rome, viz., in 1824 and 1826, for the purpose of discovering the Obelisk translated for Augustus by the Egyptian priest, Hermapion, which translation is preserved by Ammianus Marcellinus; "the great master," however, failed; and one day he assured me that the Obelisk in question "may perhaps lie in a cellar."

Additionally, in 1826, the Pope gave orders for the publication of the inscriptions on all the Obelisks standing at Rome, and Champollion himself was honorably charged with the editing and translation of the said Obelisks. In that same year, 1826, the first impressions of the plates, among which was also the copy of Hermapion's Obelisk on the Piazza del Popolo, were sent to Champollion, at Paris; and although he was repeatedly admonished to fulfil his promises, he failed, and in 1832, six years after, he died, without having recognized Hermapion's Obelisk, or translated one line of the Roman Obelisks.

In that same year, 1832, Prof. Ungarelli at Rome, and Prof. Rosellini at Pisa, the latter being the most learned disciple of Champollion, were invested with the function of translating the Roman Obelisks; and so this valuable work appeared finally in 1842. As soon as I got a copy of the "Interpretatio Obeliscorum Urbis," I came out with Hermapion's translation of the said Obelisk on the Piazza del Popolo, which I had

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identified in 1826. It was an easy thing to compare, word for word, the text of the Obelisk with Hermapion's translation, and with that made according to Champollion's system; and now what was the result? The strict followers of Champollion had furnished a translation and sentences totally differing from old Hermapion; and why?*

Further, Champollion, according to his symbolic principle, had, in his numerous works, particularly in his Dictionary, translated a great many royal surnames on the Table of Abydos, the Table of Karnak, and other monuments. Subsequently, however, the Greek translations of those same inscriptions and names, made by Eratosthenes, the author of the Vetus Chronicon, and Manetho, came to light; and thus (I am sorry to say it) it turned out that of Champollion's translations of all these royal sacred names, not a single one was correct.†

Supposing, however, that all these facts, which have been discussed *in extenso* in my Grammatica Ægyptiaca, and of which the "prudent" Reviewer, of course, says not a word, would not be sufficient to enable the reader to come to a decision, let us come closer to the subject, and examine for a moment the single principles of Champollion's system with reference to the above explained specimens.

The Jesuit Kircher, as is known, has translated whole Obelisks at Rome, by taking one part of the hieroglyphs for figurative or mimetic signs, the other for tropical, the rest for enigmatical; and, at present, every one knows that Kircher's seven volumes do not contain a single word of truth. It is true, Champollion stated that but the half of every hieroglyphic inscription consisted of figurative, tropical, and enigmatical characters, and thus reduced the nonsense one half; but this half is a hard nut for the poor scholar when he first applies himself to Egyptian studies.

I begin with Mr. Stone's Papyrus, and there the first word is expressed by a lion's claw and an arm. What may that be? Is that claw a figurative sign, or a tropical, or an enigmatic one, or even a letter? As the arm sounds *a* in Antoninus, I suppose the lion's claw to be a letter, and, indeed, Champollion's Grammar tells me that it signifies *h*. With the word *ha* happily made out, I recur to the Coptic Dictionary, where I find, "*ha*, sub, de, circa, erga, apud, ad;" besides the mutilated word "*ham*, homo," which is too modern. The following figure of an owl, I am told, sounding *m*, signifies the genitive. Then, we come to the group, translated by Champollion

* See Leipziger Repertorium, Aug. 9, 1844, p. 309, and Theologische Schriften der alten Ægypter, Leip., 1855, p. 71.

† Berichte ueber die Verhandlungen der K. Saechs. Gesellsch. der Wissensch., 1846, p. 71; Theologische Schriften, p. 94.

"victory," or, on account of the "determinative plural," victories; consequently, we translate—sub, de, circa, erga, apud, ad, the victories: but that is nonsense. We omitted, however, the "determinative, woman," as Champollion teaches; consequently, we must translate—sub, de, circa, erga, apud, ad, ab, in, super, pro, ob, the female victories. That seems to be still greater nonsense; therefore, we must begin anew. The lion's claw, perhaps, does not always signify a letter, but mimetically a lion's claw; and so we translate: the lion's claw of the female victories. That is new nonsense. The first hieroglyph must be a tropical sign, and may express strength, or bestiality, or cruelty, or avarice; and, now, we translate: the strength, or bestiality, or cruelty, or avarice of the female victories;—or, also: of the victory of the women at On. Again nonsense; for the following word is the name of a person. Finally, the lion's claw, must probably belong to the class of enigmatic signs: and, indeed, Champollion's Dictionary translates it by "beginning"; the Rosettana, by "Egypt"; Manetho, by "king Psamus;" Horapollo, by "force"; Origines, by "Decanus, Chmus"; the Todtenbuch, by "*shem*, altitudo." That is enigmatic, is it not? As, however, the number of enigmatic significations of the same hieroglyphic figure may amount to several hundreds, I, "in utter despair of determining for myself the first group," renounce the translation of whole Egyptian texts. Therefore, I begin to try single groups of our text; and look, in a moment what wonderful success. I discover at once the words: sun with a spot in the centre, moon, man, woman, son, king, god, mummy, chamber, priest, pouring out, the watchman of the starry heavens, the god of the number thousand, the gods Thothunen, the god of the festivities, and so forth; and although they are no more reliable than a "sixth-rate almanac," which sometimes prophesies snow during winter and rain in spring, I put them into my dictionary. By the way, such is the origin of Champollion's Dictionary. As soon as it contains some thousands of words, I try again to translate whole texts; and now, what translations!*

Let us come to another of Champollion's principles, for the possibility of understanding an entire hieroglyphic inscription is not yet exhausted. We begin again with the lion's claw. As this figure acrophonically sounds *h*, and as abbreviated words, like *s* for *suten*, are "very frequent in Egyptian texts," we spell the lion's claw: hab, heb hib, hob, hub; hac, hec, hic, hoc, huc; habab, habeb, habib, habob, habub; habac, habec, habic, haboc, habuc—and so forth; and in continuing thus we would gain several millions of probabili-

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* See my Summary, cet., p. 58, and other examples in the Jahresbericht der Deutsh. Morgenl. Gesell., Leips., 1846, p. 71.

ties. As, however, "few persons would indulge their taste for reading a language where this process had to be gone through for every successive word," I decide again, together with the "unmathematic" Mr. G. Long, "in my senses, not to trouble myself about deciphering a hieroglyphic text." The difficulty, however, is entirely got over by Champollion's determinatives, which we must finally try; for, although they were also in one place figurative, in another tropical, in another even enigmatical, they always say "to what class of things the determined hieroglyphic figure, or group expressed in a figure, belonged." For instance, the said third group (victory) is followed by a woman, and this, being a determinative, shows me that the victory belonged to the class of women. The same figure determines the group lion's claw and arm in VI., 68, where it signifies *chief;* consequently, the chief belonged once to the class of sitting figures, or rather to the class of women. The same figure we find after the name of the father of the deceased—unhappily, however, accompanied by the masculine article: a hard nut again; wherefore we conjecture the father to have been an hermaphrodite. Besides, the determinative of the group *pishte* (flax), viz., the sun with a spot in the centre (the pupil), demonstrates that the *pishte*, missing in all Coptic dictionaries, belonged at least to the class of suns or pupils, as well as the abstruse word *Adon.* The Egyptian crown, being determined by the figure of a city, expressed the city called Crown. The sparrow-hawk and the fox belonged to the class of whips. The word "praise" and the name "Graikos" (Greek), being followed by the determinative "penknife," belonged once to the class of penknives. The most striking proof for Champollion's determinatives, however, is his great sea-serpent.*

The passage in question translates thus: "There is a house thirty cubits long, fifteen cubits wide, and four cubits high; this is the habitation of the departed N. N. in the land of the blessed." The word house is expressed alphabetically by the letters *hpi*, i. e., *hepi* (house), and determined phonetically by the figure of a serpent, viz., *h p i*, in order to prevent a false pronunciation and translation of the preceding letters, *hpi* being ambiguous. "The great master, however," not being able to translate the following groups, and teaching that "all determinatives are symbolic," translated in his Grammar (and must either give up his system, or translate) thus: "There is a serpent 30 cubits in length, 15 cubits broad, and 4 cubits in height." This marvellous serpent, probably an antediluvian leech, must have existed once; for it is to be

* See Champollion's Grammaire, Paris, 1836, p. 244, and the *fac simile* of the group in my Summary, p. 49, and the whole passage in Lepsius' Todtenbuch, chap. 108, 2.

seen anew, among a thousand other curiosities, in the Museum kept by the advocate of Champollion's system.

Such is the key "of the whole Egyptian philology," discovered by Champollion, and verified by a new member of the "orthodox school." As everybody sees, "it is now absurd to speculate upon the possibility or impossibility of reading hieroglyphic inscriptions." Perhaps, however, the disappointed reader of the "Atlantis" will now say in the Reviewer's words: "I feel obliged to express my conviction that the whole of that system is fundamentally unsound, and simply illusory." "The fundamental objection to that system consists in the apparent impossibility of learning and teaching it," for it is not very different from the system of the Jesuit Kircher.

"We have no proof as yet" that different members of the orthodox school, as De Rougé, Lepsius, Brugsch, P. Renouf, "without communicating together, would give the same reading and interpretation" of Hermapion's Obelisk, provided they had not seen before the ancient translation, or Rosellini's.

The *second* object of the Reviewer is to make his readers laugh at the absurdities of my own system, namely, that complex of rules for reading and explaining hieroglyphic texts, the fruit of my own investigations since 1824, which I first laid down in my Rudimenta Hieroglyphices, Lips., 1826, and afterwards in my Grammatica Ægyptiaca, and Erste Anleitung zum Uebersetzen altægyptischer Literaturwerke, nebst der Geschichte des Hieroglyphenschlussels, Gotha, 1855.

The attack from the quarter of the "orthodox school" begins with telling the reader that I had changed my system several times. "Seyffarth," says the writer, "has on more than one occasion discovered the untenableness of his position, and abandoned one system after another." "Seyffarth has changed his system every five or six years." Now, since the publication of my Rudimenta, thirty-three entire years have elapsed; consequently, five or six different systems of mine must have appeared. I wonder that the Rev. gentleman did not blush to write down such palpable calumnies. Why may he not have remembered that Champollion really changed his system several times, and thrice discovered "the untenableness of his position"? He wrote, however, only for "readers who possess but what is called a literary knowledge of the controversy." The fact is, that I have never, since 1826, in any of my subsequent publications, changed the substance of my system; for the system set forth in my Rudimenta and that in my Grammatica Ægyptiaca are essentially the same, and contain the following rules for deciphering hieroglyphic texts. All the corrections of my "views," occurring in my intervening books, concern particularities, and do not affect the substance of the system at all; and these are sufficiently accounted for from the difficulty of the matter.*

1. The language expressed in Egyptian texts is the sacred dialect (ἱερὰ διάλεκτος), i. e., the ancient Coptic, differing from the modern Coptic as the ancient Greek differs from the modern, and being more nearly related to the primitive language, the Hebrew, than the modern Coptic. This principle excludes that of the Jesuit Kircher, according to which the hieroglyphic language was ideal; further, that of Champollion, according to which one half of every inscription signifies ideal conceptions, the other half modern Coptic words; likewise, that of Young, according to which all hieroglyphic figures, except those of the proper names, are also symbolic; that of Sickler, who made the hieroglyphic language a mixture of all Semitic languages; that of Janelli, who supposed "la lingua Ebraica ma piu pura."

2. The leading principle is that each hieroglyphic figure expresses the consonants contained in its name; e. g., *ms* was represented by the phallus, *kr* by the sparrow-hawk, *tn* by the forehead, *kp* by the leaf, *tb* by the finger, *htr* by the hatchet, *stn* by the flax-stalk, *mlk* by the owl, *kll* by the well-bucket, *km* by the lion's claw, *ank* by the belly, *bkr* by the fox, and so forth.† The vowels were commonly to be supplied by the reader, and occur as seldom as the primitive Hebrew vowels א (*a*), ה (*e*), י (*i*), ע (*o*), and ו (the ancient ϒ, dropped in the Hebrew after ת)‡; consequently, the Egyptian mode of writing was not at all different from the aboriginal mode, preserved in the Hebrew and all the Semitic languages. This principle excludes Young's theory, according to which vocalized syllables, as *ole*, *ench*, *bir*, were represented by the hieroglyphs, and, at the same time, Champollion's doctrine that all hieroglyphic figures expressed but one sound. ("Les caractères phonétiques se combinent entr'eux pour former des

* Collate: Rudimenta, 1826; Bemerkungen ueber die Æg. Pap. zu Berlin; Réplique aux Objections de M. Champollion, London Lit. Gaz., 1828, No. 600; Astronomia Ægypt.; Neue Jahrbucher fur Philol., vol. X., p. 182; Alphabeta Genuina; Grundsaetze der Mythologie und Hieroglyphensystem, Leipziger Repertor., Aug. 9, 1844; Verhandlungen der Orientalisten, 1845; Jahresbericht der Deuts. Morgenl. Gesell., 1846; Verhandlungen der K. Saechs. Gesell. d. Wiss., 1846; Jenaische Literatur Zeit., 1847, No. 204; Zeitscrift d. Deutsch. Morg. Ges., 1848, p. 63—1850, p. 377; Leipziger Repertor., 1849, vol. II., p. 1—1852, vol. I., p. 1—1853, vol. I., p. 155; Layard's Niniveh, Appendix, Leip., 1854; Grammatica Ægyp.; Theologische Schriften d. Æg.; Berichtigungen der alten Gesch.; Summary of Recent Discoveries; Transactions of the St. Louis Academy of Science, 1858, p. 209—1859, p. 356; and others.

† See the figures in my Summary of Recent Discoveries, pages 38, 41, 42, 48, 51.

‡ See my pamphlet, Ueber die ursprünglichen Laute der Hebraeisshen Buchstaben, Leip., 1824; De sonis literarum Græcarum, Lips., 1824; Unser Alphabet, ein Abbild des Thierkreises, Leips., 1834.

mots comme les lettres de tout autre alphabet"—the phonetic hieroglyphs are combined in order to form words like the letters of all other alphabets.)

3. In many other hieroglyphic groups each figure expresses the first sound of its syllabic power, consequently that with which the name of the hieroglyph begins, as is the case in the Hebrew.

4. The syllabic hieroglyphs, in order to distinguish them from the alphabetic ones, are commonly determined by the figure of a mount, like the *dagesh forte* in the Hebrew, or by subsequent figures expressing alphabetically what the preceding one syllabically says.

5. A number of Egyptian images, as the case is in all languages, bore different names; therefore they expressed both syllables differing in letters from their original names, particularly on later monuments.

6. The alphabetic groups are commonly followed by a determinative for the purpose of fixing their pronunciation and signification, being, in consequence of the omitted vowels, sometimes ambiguous, like many Hebrew words.

7. No hieroglyphic figure, particularly no determinative, is to be taken for a symbolic sign, expressing either mimetically, or tropically, or enigmatically, a conception or idea. Even those figures which are most fit for expressing symbolically a word, express in other connexions the elements of the spoken language, e. g., the crescent. This principle excludes all the systems of Kircher, Ricardi, Palin, Young, Champollion, and others, who stated the Egyptians to have more or less used symbolic figures for expressing entire ideas. The only exceptions are the astronomical figures, signifying the Planets and Zodiacal Signs, as is demonstrated in my Astronomia Ægyptiaca, Lips., 1833, and latterly in the Transactions of the St. Louis Academy of Science, Vol. I., p. 357.

8. The names of all the 600 hieroglyphic figures of the ancient Egyptians, upon which depend both their syllabic and alphabetic pronunciations, were first explained in my Lithographic Plates, printed in 1845, and appended to my Grammatica Ægyptiaca. Of these 600 names, however, no less than 80 had been previously determined by the sagacity of Young, Champollion, and subsequent scholars, although they had, as yet, no presage of the real key to the whole Egyptian literature.

The way by which I arrived at that system was as follows. I compared at first a great many different copies of the same sacred Egyptian records, word for word, the one with the other, and then tried to decipher, not single groups, as Champollion did, but the whole inscription of Rosetta, and other entire texts. Afterwards, I was so happy as to discover Hermapion's Obelisk and five other bilingual inscriptions; by which I succeeded in determining the true names and syllabic values of nearly all hieroglyphic characters. As regards the different copies of the same Egyptian texts, they put very frequently two or three letters for a syllabic sign, expressing those same letters, e. g., *kr* for the sparrow-hawk; and thus I discovered a great many syllabic hieroglyphs, and determined their syllabic values. It is absurd to deny that the different copies of the "Todtenbuch" are useful in this respect.

Let us see, now, how the Dublin Reviewer proves to his readers that my system is "fundamentally unsound and simply illusory." His proofs are selected from my Chrestomathia Hieroglyphica, printed in 1845, although the Preface expressly says that those specimens contain some mistakes; and I do not wonder that the Rev. Reviewer did not select some specimens, printed ten years later, in my "Theologische Schriften der alten Ægypter," although he cites them.

Everybody (even a schoolboy) sees, except the "orthodox school" at Dublin, that whoever states *that each hieroglyph expresses syllabically the consonants contained in its name, and alphabetically the first letter of that very syllable*, ascribes but *two* powers to a hieroglyphic figure. What did our friend do? He tells his faithful readers that I had "attributed to *each* character half a dozen of the *principal* consonants"! "Every hieroglyphic character had an indefinite number of alphabetical values." Now, the "principal consonants," according to the ancient Greeks, are the following twelve: *b p*, *g c k q*, *d t th*, *f v p h*, *h ch*, *l*, *m*, *n*, *r*, *s*, *sh*, *w*. "And with this key," continues the jovial man, "it is not difficult to to make out the Ten Commandments, the Psalms of David, the Homeric Poems, or the Irish Melodies, on any ancient or modern monument whatever, and in any language you please." I do not deny at all that possibility, particularly for the Irish Melodies; but the misrepresentation being too monstrous to be discussed, I simply call him a falsifier who will not demonstrate that I have done so.

Furthermore, it is known that the Coptic language, in consequence of the different dialects spoken in Egypt, is one of the most corrupted languages of the world. Every dictionary shows that nearly every Coptic word was, in other parts of Egypt, and in other books, pronounced differently. Thus, we find the same words written: *e*, *a*, *ai*, *o*, *oi*, *ô*, *ôi*, *ahe; shêêre*, *shêêli*, *sheere*, *shêli*, *shere*, *she; rês*, *roeis*, *rôis; rat*, *ret*, *rêt*, *rêti*, *rot*, *rôt*, *roti*, *rt; hun*, *khun; peh*, *pheh; tsamul*, *dshamaul; ke*, *dshe; fo*, *bo*, *foi*, *fôi; shto*, *shte*, *ste; shash*, *shuosh*, *sesh; pat*, *phat; shom*, *dshom*—and so forth. Now, in order to aid the student, who, in referring a hieroglyphic group to a Coptic root, must resort to his memory or to a Coptic Dictionary, I deemed it necessary, concerning each hieroglyph explained in my Grammar, to show what Coptic letters in different Coptic words corresponding with certain hieroglyphic groups were expressed by the very same hieroglyphic figure; for that reason I put in my lithographic Alphabet, opposite the single hieroglyphs, the Coptic letters, corresponding in some modern Coptic words with the hieroglyphs in question; and these corresponding Coptic letters were found by translating the said bilingual inscriptions, and those whole texts in my "Theologische Schriften" and other books. An example will illustrate that:—The tree (Gram. Æg., No. 361) being called *ashe*, can have but *two* sounds, according to my system, namely, *ash* (syllabically) and *a* (acrophonically). I found, however, that the tree expressed, in the modern Coptic, sometimes *a*, sometimes *e*, sometimes *es* or *s*; therefore, I mentioned in my Grammar, first, the original name of the tree (*ashe*), in order to determine its original syllabic and alphabetic value, and then the Coptic letters referring to the tree in later times, viz., *a*, *e*, *es*, *s*. How correctly I did so, and how useful for a scholar my proceeding was, the subjoined Plates may show. The said tree expresses *a* in *avo*, and, et (VI., 23, 40, and others); also, *c* in *chou*, seasons (VI., 28, 106, cet.); likewise, *es* or *s* in *ham-kap-s* and *mesh-es* (VI., 12, V., 35), where it makes the substantives—obscuritas, from *kap* (obscurus); government (*mesh-es*), from *mesh* (potens): consequently, with the Coptic *es* and *s*, like the Latin *tas* appended to adjectives, e. g., purus, puri-tas; æternus, æternitas. The same is the case with all the other hieroglyphic figures applied, in my Grammar, to Coptic words. But look, what did the Rev. Mr. Renouf do? He assures his readers, I had "attributed to *each* character the *principal* consonants—that is, only about half a dozen sounds,"—and that with my "key" it would be possible to read "Irish Melodies" in any hieroglyphic text whatever, although he knew my "key" perfectly well. And why did he do so? Probably he acted in accordance with the maxim, "the end justifies the means." His article would make the reader forget the rule, and substitute the modern Coptic for the ancient by means of a Mexican puzzle.

Further, the same author demonstrates by a Plate, copied from my Chrestomathia, p. 64, and taken from the Todtenbuch, p. 65, that it is impossible to read and translate a single group by means of my system. The first two groups of that specimen contain the following figures: tree, owl, serpent, mouth, mount, arm,—which, as no syllabic Diacriticum is added, pronounce alphabetically. Consequently, the first group, followed by the suffix *f*, can not, according to my Alphabet, be spelled otherwise than *am* or *em*. The system of Champollion gives *am*, or *em*, or *im*, or *om*, or *um*,—which may be easier for the Reviewer's philosophy, because "the Hebrew word אדמה (*adama*) is then susceptible of several hundred pronunciations." As, then, no word *am* exists, and *em* with the suffix *f* signifies "non est," and as the following group is translated in the Rosettana by "similis," we obtain the simple sense—non est similis. The learned Reviewer, however, "utterly despairs of determining for himself this first group by the help of Seyffarth's system, and, in that case, supposing he told the truth—and, certainly, a Rev. Professor of the Catholic University of Ireland never lies,—it would be best for him to keep his hands off from hieroglyphic matters, and, rather, to settle in Abdera and boil hellebore. Indeed, the same genius, in his second article, "Hieroglyphic Studies," in the Atlantis, 1859, No. IV., p. 333, discloses so profound an acquaintance with the Coptic, the Hebrew, and with the Egyptian Mythology, that, I am sorry to say, I have never, in the whole of my life, met with greater absurdities.

As concerns the aforesaid hieroglyphic groups, "non est similis," it is to be mentioned that they came, by a mistake of repetition, from the preceding line down into the following (Chrestomathia, p. 62), and thus they took the place of the true groups, mouth, boundary-stone, water, house, mouth, feet, —i. e., *hro n alei* (oratio de magistratu)—with which group nearly all chapters in the "Todtenbuch" and in my "Chrestomathia" begin. I corrected that *erratum* upon the proof-sheets myself, but the fault was the lithographer's; thus those two wrong hieroglyphic groups remained, while the apposed *hro n alei* (oratio de magistratu) referred to the said true groups. The Rev. Reviewer knew that; he knew to what groups the words *hro n alei*, and their traslation, "oratio de magistratu," belonged; he says even that those wrong groups (tree, owl, snake, mouth, mount, arm), in the fifth text, "came by a *curious coincidence* together in the very last line of the fourth text;" he had the original, Lepsius' Todtenbuch, at hand, and looked in it; he knew with what groups all those chapters begin; notwithstanding his declaration, "it does not much matter which text we select," he selected two printer's errors, and recurs to them repeatedly for the sole purpose of demonstrating that, according to my system, it would be possible to spell the same group as well *reti* as *alei*, or *hraam*, and to make any text whatever yield several hundred different meanings; consequently, that my system is "ridiculous in the extreme."

In consequence of this fabrication, the Rev. Mr. Renouf further tells his readers, "those groups are not by any means exceptional ones. It is the very nature of the system to interpret the same group an indefinite number of ways;" and "a text consisting of fifty groups may be read in several hundred ways." In fact, the practice of judging systems by the instrumentality of printers' errors is quite new in the history of Egyptian literature from the exhumation of the Rosetta-stone down to 1859, and is really so base that, in our language, there is no fit expression for it.

Furthermore, the Reviewer assaults my principle, according to which some hieroglyphs received different, both ancient and modern, vulgar and poetical names; wherefore they sometimes expressed, both syllabically and alphabetically, different letters. He ridicules the idea that the bull signifies *k* in the name Necho, *r* in Cæsar, *t* in Tor; the young chicken, and the ball of yarn, and the eared-snake, sometimes *h*, sometimes *o*, sometimes *f*; the shop, *b* and *s*; the two trees, *i* and *s*; and so forth.* In this blind assault, however, he is somewhat unhappy; for, as the ambiguity of those very same hieroglyphic figures—although first observed, in 1826, in my Rudimenta, and first explained in 1845—was discovered by Champollion himself, and by the "orthodox school" by their "own investigations," the Reviewer rather lacerates the bowels of the "great master," and his friends, whom he intended to glorify. In fact, this ambiguity is very "fatal" to that system, which taught that each hieroglyph expresses but one sound, "comme les lettres de tout autre alphabet," and "like the Hebrew letters."

The pious man also condemns my practice of reducing, sometimes, the same hieroglyphic figures or groups to different Coptic roots, or, in one word, of always translating them conformably to the context; he does so without being aware that he, at the same time, condemns the whole of the Hebrew Testament and its translations, the Septuagint and St. Hieronymus, and even Horapollo, who refers many words to the same hieroglyphic figure containing the same consonants. The old Hebrew mode of writing is quite the same as that of the ancient Egyptians; for both expressed words only by consonants, and commonly omitted the vowels, which the translator had to supply according to the context. Thus, e. g., the Hebrew letters *br* signify—filius, electus, purus, inanis, frumentum, campus, puritas, lixivium. The same is the case with some groups and figures occurring in the above explained texts, expressing one thousand, and also obscuritas, ten and bruising, captain and book and Egypt, height and strength, by the same consonants. How dull the Septuagint and St. Jerome were while translating the same two or three Hebrew consonants by different Greek and Latin words; and, perhaps, the new Horapollo of Dublin will give the Christian world the benefit of a new LXX., or Vulgata, in which all combinations of the same Hebrew consonants are constantly expressed by the same words. As, however, the Rev. Professor testifies to the world, "it is the very nature of the system to in-

* See Champollion's Dictionary, pp. 269, 161, 129, 116, 115.

terpret the same group an *indefinite* number of ways," I commit it to the world to crown such truths, as soon as they are proved.

Further, the author charges me with "hunting after Hebrew and Chaldaic words" in explaining hieroglyphs. Perhaps, however, he belongs to that class of savans who take the Hebrew for a modern language, and the Sanscrit, or Japanese, or Mexican, for the primitive tongue. Then, in meeting with Egyptian words wanting in our Coptic dictionaries, e. g., with the word *adon*, he will probably recur to the old Mexican dialects, where *adon* sounded like *brek-kek-kek-koaks-koaks;* and for deciphering that *pishte* produce a root like *y*, *ý*, *ỳ*, *ŷ*, *ȳ*, *y̆*, *i*, *a*, *e*, *o*, *u*, *king-kang-kung*.

He also reproaches me with "having, instead of facilitating the translation of Egyptian texts, cast it into impenetrable darkness." Indeed, in the times of the Jesuit Kircher, who ascribed to each hieroglyph an indefinite number of ideas according to his fancy, and thus translated the Roman Obelisks, it was a very easy thing to translate entire texts. In the times of Champollion, it was nearly the same; for the half of every inscription consisted of mimetical, tropical, or enigmatical figures, also suited for every student's fancy. The said example illustrates it. The lion's claw signifies King Psamus, because he was, at that time, the lion of the people; the same figure expresses Egypt, because it was once full of lions' claws; it represents strength, which it also symbolizes; it denotes the chief, viz., the lion's-claw of his subjects; it expresses the idea book—I do not know if mimetically, or tropically, or enigmatically; and so on. Bravo! says the learned Reviewer; this is the true key to the hieroglyphic literature. Another one, however, knowing that the lion's claw was called *kome*, refers it, in deciphering Egyptian texts, to a few Coptic words containing the same consonants. And now, what "key" is easier? By symbolism it is possible to bring out of each hieroglyph a thousand different meanings; by syllabism, a few words mentioned in the dictionary.

At present, then, things are changed, and the art of explaining hieroglyphic inscriptions is confined to the field of Oriental Philology. The student must learn Coptic, and that profoundly, and, besides, the syllabic values of 600 figures; which, probably, is too hard for an Egyptologist in the Green Island. The real difficulties which a beginner has to overcome are acknowledged in my Grammatica Ægyptiaca, and there, by certain advice, diminished; they are, however, not greater than those of translating the Hebrew Testament, or a Phœnician inscription, destitute of vowels; and the Septuagint has demonstrated such difficulties to be easily overcome. As respects the ambiguity of some hieroglyphs, a great deal of it affects only modern inscriptions, where, e. g., the child (*sheri* for *kere*) sounds *s* for *k* acrophonically, as is explained in my Grammar. Perhaps, however, the wise Egyptologist of Dublin believes that the Egyptian language, with all its particulars, remained the same during three thousand years. It is a pity that our learned Hieroglyphist was not born in the times of Thoth, 2800 B. C.; he would then, it is likely, have invented an easier hieroglyphic system than that of the foolish god, in perfect accordance with his own taste, and, certainly, would not now be fighting against windmills.

Further, he denies that the so called induction-proof, for which I called in my Grammar, proves any thing in favor of my system. "If this, he says, "be true, Mr. Osburn's system is as infallibly correct as that of Seyffarth," and (he ought to have added) as that of the Jesuit Kircher. In proof of this, he gives a witty illustration similar to the following. A schoolboy, in order to show his companions how much he had improved in Latin, translates thus: *Integer* (my) *vitæ* (good) *scelerisque* (Michael) *purus* (loves) *non* (me) *eget* (with) *Mauri* (Irish) *joculis* (faithfulness). The difference is only that the erudite Academical Professor has not learned what induction-proof is, and that my induction is a little different from that of Dublin; for Mr. Renouf misquotes my words (Gram., p. 35), which read thus: "The induction-proof for the correctness of a hieroglyphic system is to succeed in *logically* translating entire texts according to that very same system. Whoever deciphers whole inscriptions, while he always ascribes the same sounds to the same hieroglyphic figures, attaches the same significations to the same groups, applies the same language and the same grammar, follows the same principles, and thus finds a reasonable sense; he must have discovered the true key to such inscription." Wresting another's words from their true sense is equivalent to lying.

For the rest, I take the liberty of proposing to the reader a hard riddle:—How was it possible, by means of a hieroglypic system "wholly unsound and simply illusory," and of a so "marvellous key," to gain, after thirty-five years, the first *grammatical* translation and explanation of the Rosetta-stone; of the Flaminian Obelisk, translated by Hermapion; of the Tables of Abydos and Karnak, translated by Eratosthenes and Manetho; of the Philæ-door, translated in the Rosettana; of the Decani, translated by Firmicus; of a great many entire inscriptions and chapters, and the whole first sacred book of the Egyptians, and, finally, of Mr. Stone's Papyrus; while the "great master" and the whole "orthodox school," by means of the "true system," "the foundation of the whole Egyptian Philology," had accomplished nothing of all that?

We come now to the "*punctum saliens*" in this notable article. The Rev. P. Renouf knew very well that the doctrine, that every hieroglyphic figure, above all, expresses phonetically the consonants contained in its name, is the real key to the whole Egyptian literature. As this discovery, however, was made by an antagonist of the "orthodox school," the Reviewer makes all possible efforts to persuade the learned world that this important discovery was not at all made by me, but either by Champollion himself, or by Dr. Young, or by Lepsius, or by De Rougé. For this purpose, in the "Atlantis," 1859, Vol. IV., p. 338, he wrote as follows: "It is to insist upon it, that the only kind of syllabic value admitted by Egyptologists at the present day was fully recognized by Champollion." In the preceding volume of the "Atlantis," p. 91, however, we read: "If the first assertion of the syllabic use of hieroglyphs be the matter in litigation, the rightful claimant is not Seyffarth, but Dr. Young." In the preceding volume of the "Atlantis," p. 337, we read thus: "The first great step in advance after Champollion's death concerns what we now call the *syllabic* signs, the true theory of which was *first* promulgated by Dr. Lepsius, and *perfected* by M. de Rougé." Now, which of these four statements is to be taken as true? Surely, this critic needs a better memory.

Let us come closer to the purpose. First, the Rev. Reviewer asserts that Champollion had, before me, Young, and all others, discovered the said "key" to the hieroglyphic literature. This position is proved—

1. By the following passage in the "Revue Archéologique," Vol. XIV., p. 593, containing an article read before the "Societé des Sciences" of Grenoble, in 1810: "As all Egyptian words are formed by (?) monosyllabic 'significatifs,' these same monosyllables must reduce them to a positive number. Then, it was very easy to construct a syllabic alphabet; and, in all probability, this was the nature of the hieroglyphs." * This, proof, however, seems to me, to prove *too much*, and misses the mark; for the question is not, what person first of all promulged the "idea" that the hieroglyphic figures expressed syllables; but, who, first of all, demonstrated by facts, like my Rudimenta in 1826, and my lithographed Alphabet of 1843, that the hieroglyphs really did express certain syllables in a certain language. The first "idea" that whole words were syllabically expressed by one hieroglyph, we find promulgated 1600 years B. C., viz., in the "Horapol-

* Puisque tous les mots Egyptiens sont formés de monosyllabes significatifs, ces mêmes monosyllabes devraient se reduire à un nombre fixe. Alors rien n'était plus facile que de composer un *alphabet syllabique*, et selons toutes les probabilités telle était la nature des hiéroglyphes."

linis Hieroglyphica," to which I owe my *real* syllabic figures. I ask, then, is it possible to "open a real door" by the instrumentality of a "probable" or rather "ideal" key? Alas, for thee, Columbus! it is demonstrated now that thou didst not discover America, since Herodotus had the first "idea" of the great Atlantis, and, to deal justly, it is now time the new continent were called *Herodota*. Moreover, Champollion's "idea" is totally different from my own "key;" for Champollion discovered as early as 1810 that "probably" each hieroglyph expressed a whole Coptic "monosyllabic" word, consisting of consonants and vowels, like the so called *rebus*. I, myself, discovered, from 1826 to 1845, that each hieroglyph expresses only the consonants contained in its name, e. g., the phallus, *ms;* the sparrow-hawk, *kr;* the owl, *mlk;* and so on. In short, according to Champollion's first "probability," the hieroglyphic texts were real rebuses, while, according to my system, both Egyptian and Hebrew texts were written quite in the same way; they contained but consonants, and very seldom expressed the aboriginal vowels. For the rest, supposing that Champollion had, in 1810, discovered the true "key" to the hieroglyphics, he must have lost it soon after; for, in 1823, in his *Précis*, Champollion clearly demonstrated that Dr. Young's and his own "rebus-theory" was wrong, and since that time he admitted but alphabetic and symbolic hieroglyphs. "I, myself," says he, "have taken every hieroglyphic character for a simple letter, and not for such as represent one or two syllables. The phonetic characters are combined, in order to form words, like the letters of all other alphabets."† What a deplorable loss for the learned world, the loss of Champollion's "key," discovered in 1810! Had this "rebus-key" not been lost, our libraries would have contained now, after 50 years, a mass of translations of very old and interesting books, I suppose, written in the time of David, Moses, and even of Menes, 700 years after the Deluge; Champollion's Grammar and Dictionary would never have appeared any more than my Grammatica; and this Reviewer would have been saved the trouble of much painful labor.

2. "It may, or may not, be true that the whole of Seyffarth's system consists in the assertion of the syllabic principle; but it is ludicrous in the extreme to talk of the negation of that principle as constituting the essence of Champollion's system." "There is no arguing with people who talk such nonsense." For want of arguments, the author is sometimes sarcastic. "This kind of syllabic value," says he, "has been

† Ch.'s Précis, p. 28. "Moi, qui ai considéré chaque caractère hiéroglyphique comme une simple lettre, et non pas comme pouvant représenter chacun une ou deux syllabes. Les caractères phonétiques se combinent entre eux pour former des mots, comme les lettres de tout autre alphabet."

acknowledged, from the very first, by Champollion and his earliest followers;" and again, "the only kind of syllabic value was fully recognized by Champollion." As the Reviewer omits the proofs for this assertion, we must look at Champollion's own words in his works; (Précis, 1824; 2d edition, 1828; and his extensive Grammar, 1836;) for, as every Grammar is written for the purpose of instructing a scholar what rules he has to observe for understanding a written language, Champollion must certainly have developed, in his Grammar, his theory concerning the first elements of the Egyptian writings, and the true signification of the 600 Egyptian hieroglyphs. Now, in the Précis, p. 381 (447), we read, "the *phonetic* characters are real alphabetic signs, expressing the sounds of the words of the Egyptian spoken language. Each *phonetic* hieroglyph is the image of a physical object, of which the name in the Egyptian spoken language began with the same sound or articulation which was to be expressed by the sign itself."* Further, in the last work of Champollion—his Grammar, p. 27—we read: "The whole of the phonetic signs constitute a real alphabet, and not a *syllabarium*;"† and never did the Egyptians express their ideas "*par la notation des syllabes*." Moreover, we find in Champollion's Grammar many Plates, representing all hieroglyphic figures (being phonetic, according to Champollion), viz., 232, but not a single Plate representing the syllabic values of the 600 Egyptian hieroglyphs, or even half a dozen of them, although "the syllabic value was fully recognized from the very first by Champollion." We ask the reader, then, do the words "non pas un syllabaire," and "non par la notation des syllabes," pronounce the "negation of the syllabic principle," or not? It is possible, however, that the Rev. Reviewer adheres to the opinion that Champollion meant the contrary of what he said, and that, in general, our talking is not made for expressing our thoughts, but for concealing them; and, in this case, the words "non par la notation des syllabes" signify—the Egyptians expressed their ideas "par la notation des syllabes." It is possible, also, that Champollion wrote down these principal rules only for common people, and, according to the *reservatio mentalis*, had another doctrine, fit only for the initiated scholars. Such were Un-

* "Les caractères phonétiques sont des véritables signes alphabétiques, qui expriment les sons des mots de la langue Egyptienne parlée. Tout hiéroglyphe phonétique est l'image d'un objet physique, dont le nom, en langue Egyptienne parlée, commençait par la voix ou par l'articulation que le signe lui-même est destiné à exprimer. Les caractères phonétiques se combinent entre eux pour former des mots, comme les lettres de tout autre alphabet."

† "La série des signes phonétiques constituit un véritable alphabet, et non pas un syllabaire."

garelli and Rosellini, the translators of the Roman Obelisks, of which the latter studied hieroglyphs at Paris, during a whole year, viz., at Champollion's side, in 1828 and 1829. In that work, (Interpretatio Obeliscorum Urbis, Romæ, 1842,) strictly following Champollion's exterior and interior system, there is again no trace of the 600 syllabic Hieroglyphs published by me in 1845; and why not? Besides, I ask, why is it that Champollion, the "discoverer of the key of the Egyptian literature in 1810," who had, "from the very first, acknowledged the syllabic principle," did never, during twenty-two years, succeed in translating the Rosettana, containing, among 700 groups, more than 400 syllabic figures? Why is it that Champollion never tried to make out the Coptic names of all the 600 Egyptian hieroglyphs, although he knew, "from the very first," that upon the name of every hieroglyphic figure depended its syllabic pronunciation? Why is it that Champollion's Grammar imposed wrong names upon nearly all hieroglyphs?

3. "A good many of De Rougé's syllabic hieroglyphs," says the "orthodox" Hieroglyphist, "are to be found in Champollion's Grammar and Dictionary" (which he ought to produce); consequently, Champollion himself discovered the "key" to the hieroglyphic literature. As, however, Champollion's Grammar and Dictionary appeared ten years after my Rudimenta, in which, for the first time, many syllabic hieroglyphs were published, the very just Reviewer ought to have declared differently. For the rest, my lithographic alphabet, showing all the syllabic hieroglyphs which were discovered by Champollion after my Rudimenta, proves that Champollion, after the last edition of his Précis in 1828, had "discovered" but five or six syllabic hieroglyphs expressing two consonants, of which three are wrong, and five are vocalized syllables—like Young's "rebus-theory," rejected by Champollion himself in his Précis. From these facts the "orthodox school" concludes as follows:—Although no hieroglyphic inscription can be truly translated without the rule that each hieroglyph, above all, expresses the consonants contained in its name, and although Champollion teaches that "no hieroglyphic character expresses a syllable" (except five or six, discovered after my "key"); nevertheless, Champollion's system is the true "key" to the Egyptian literature. And from this ingenious conclusion I learn that the Dublin Philosopher has studied Aristotle's Logic, and that he is about to establish a new school of Philosophy.

As, then, nobody has ever yet demonstrated it to be possible, according to Champollion's system, as it is printed, by following his rules and his syllabic figures, to decipher, logically, a bilingual inscription, or any whole text, we come to the other problem of the "Atlantis," that, at least, Dr. Young had before me discovered the true "key" to the hieroglyphic literature. The Reviewer mentions that Young, first of all, discovered thirteen phonetic hieroglyphs, of which some expressed syllables, as *bir*, *ken*, *ole*, *eneh*; although "all Dr. Young's syllabic values have unluckily turned out to be incorrect." The "loop-hole," however, is again the "idea" of syllabic hieroglyphs; and, we repeat, the question is not who first promulged the "idea" of some syllabic hieroglyphs, but who first demonstrated that all hieroglyphic figures do in fact, and as a general rule, express certain syllables. Secondly, my syllabic hieroglyphs, expressing two or three consonants without vowels, are altogether different from Young's "idea." Moreover, in spite of Young's true discoveries, it is obvious that his rebus-theory, even being extended to all hieroglyphic figures, would, in spelling any text whatever, produce very monsters of Egyptian words, not occurring in any Coptic Dictionary, nor in any language. Furthermore, Dr. Young's "theory" that all hieroglyphic groups, except the proper names, must be explained symbolically, prevents every Egyptologist, according to Young, from truly translating whole texts; which "idea" is also totally different from my "key."

Again, regarding the assertion that "the true theory of the syllabic signs was first promulgated by Lepsius in 1837, and perfected by M. de Rougé in 1851," the astute author again inverts the question. The "idea" of Lepsius, "promulgated in 1837," was not, that all hieroglyphs express certain consonantal syllables without vowels, as I had demonstrated partly in 1826, and universally in 1845; but he "promulgated," that the half of every hieroglyphic inscription consists of figurative, tropical, and enigmatic signs—the other half, of mere letters, and of a number of abbreviations expressing such vocalized syllables as were discovered by Dr. Young in 1819; which does not harmonize at all with my "idea." At the same time, the Rev. Reviewer curiously forgot, that, eleven years previously to Lepsius' "idea," many syllabic hieroglyphs had been "promulgated" in my Rudimenta, viz., in 1826. Besides, of those 54 syllabic hieroglyphs "first promulgated" by Lepsius, 25 were proved to be wrong by Chevalier Bunsen, and of the 29 remaining figures but few are correct. Finally, the ludicrous basis of Lepsius' and De Rougé's "idea" is as follows. The first writing of the world, especially in the days of Menes, was but figurative; by and by, two or three or four figures, according to impenetrable tropical or enigmatic rules, were coupled for expressing an idea or notion; then the second and third figures of such a group were dropped, in order to express the same idea by the remaining initial, which, although being symbolical, finally turned out to pronounce syllabically, like Champollion's abbreviations; and, at last, the same initial was used for words sounding similarly. Indeed, this is treating the sound common sense of mankind with contempt. By this foolish "idea," of course, Mr. Lepsius and De Rougé were totally prevented from determining the syllabic value of all the other 600 hieroglyphs, and, consequently, from translating entire texts. Supposing, however, Mr. Lepsius had discovered, in 1837, the real "key" to the whole Egyptian literature, why is it that he has never, during twenty-two years, translated one hieroglyphic line? Or, is it possible to open a door by means of a bit of a key discovered before him?

Finally, we come to the apology for Messrs. Lepsius, Brugsch and De Rougé, who were, in my Grammatica Ægyptiaca, charged with deserting Champollion's standard, and clandestinely appropriating my key and syllabic alphabet. Thus, the Reviewer says, "they (Dr. Uhlemann and I) assert that Lepsius, Brugsch, De Rougé, and others, have abandoned the system of Champollion, and dishonestly availed themselves of Seyffarth's key, without giving him the glory of its invention." As Champollion, in his Précis and Grammar, as we have seen, clearly gives the rule of taking no hieroglyph for a syllable, and as he, in all his works, observes that same rule, and finally admitted, in his last work, but five or six really syllabic figures as exceptions to the general rule, I call persons who admit other syllabic hieroglyphs than those named by Champollion and excepted from the rule—who take, in translating a text, 20 or more hieroglyphs out of 100 for syllables—simply, renegades. In case the same persons give to those same hieroglyphs the syllabic values discovered before and divulged by another scholar, without naming the author, or even pretending to have made that discovery themselves, then I call such persons literary thieves. Such was the ancient usage in learned society.

Now, in 1845, Mr. Lepsius received a copy of my printed syllabic alphabet, and, in 1848, he published his Egyptian Chronology, particularly the names of the Astronomical Decani, syllabically expressed on five different monuments, which were inexplicable according to Champollion's system. In explaining them, however, Mr. Lepsius applied my "key," first published in 1826, and confirmed in 1833, 1840, 1843, 1844, 1846 and 1847, according to which each of the 600 hieroglyphs expresses, in the first place, the consonants contained in its name; moreover, he assigned, there, to 18 hieroglyphic figures the very same syllabic values which he had found in my printed Alphabet, without mentioning its source. I ask the reader, then, has Mr. Lepsius, indeed, deserted Champollion's standard, and adopted my "key," and "dishonestly stolen" my property, or not?

Mr. Brugsch published, in 1849, his "Doctrina numerorum Ægyptiorum," and "Uebereinstimmung einer Hieroglypheninschrift," in which he, as yet, strictly followed the system of "the great master;" and although his texts offered a mass of syllabic characters, he admitted, of course, not a single one, all syllabic signs being excluded from Champollion's system. Soon after, however, he received a copy of my Syllabic Alphabet; and then, in 1851, as soon as possible, his "Interpretatio Rosettanæ" appeared, in which Mr. Brugsch adopted my "key," and discovered the Rosettana (once inexplicable to Champollion) to contain 152 syllabic characters, viz., the same which, except some mistakes on the part of Mr. Brugsch, were first determined in my Alphabet, which was then in his hands. In order to remove the appearance of plagiarism, the Introduction to this otherwise very valuable work* prudently calls my system "vana ficta," and praises the "great master." I ask the reader, then, if Mr. Brugsch has really abandoned Champollion's printed principles, and appropriated my "key," and "dishonestly stolen" my literary property, or not?

In the autumn of 1849, M. de Rougé visited Berlin, and published there a pamphlet, entitled "Essai sur une stèle funéraire. Dédié à M. A. de Humboldt." Although this inscription contains nearly 50 syllabic figures, M. de Rougé, of course, still following the system of Champollion, failed to recognize a single one. Soon after, he received a copy of my printed syllabic Alphabet, and then, in 1851, he published a large work—"Memoire sur l'Inscription du Tombeau d'Ahmes"—in which he first deplores the condition of Champollion's system, "according to which it would have been impossible to decipher this inscription;" he then speaks very disrespectfully of my own researches, and finally discovers the "key" to the Egyptian literature, namely, that the said inscription contains more than 30 syllabic figures, of which 20 are still to be found in my lithographed Alphabet. Therefore, I ask again, has M. de Rougé deserted Champollion's system, and silently approved my "key," and "dishonestly stolen" another's property, or not?

First, however, we must hear what the Rev. Reviewer has to say in favor of those gentlemen.

The full justification of the defendants is, that the Dublin judge has seen with his own eyes that those honest men lighted their cigars with my Plates before looking at them. This argument, however, must, as yet, be reserved in mind.

* See Leipziger Repertorium, 1852, Vol. I., p. 26, where it is demonstrated that the author corrupted the original text, and corruptly explained only 12 groups by his hand. Such is the nature of all the numerous publications of this young rash scholar. It is a pity that the Philomathean Society of Philadelphia has adopted this deplorable explanation of the Rosettana without first comparing it with my translation in the Theologische Schriften, cet., Leipsic, 1855, p. 58.

Further, as those gentlemen had, in former times, exaggerated Champollion's merits in the extreme, and, in their blind jealousy, exceedingly defamed and rashly condemned the contrary system, which, in opposition to the whole world, refused to admit any symbolical hieroglyph in Egyptian writings, it would have been too shameful for the "orthodox school" to change opinion, and *publicly* adopt the system which they had, a long time since, publicly repudiated. This argument, also, remains "sous-entendue."

Further, those gentlemen, says the Reviewer, have "not adopted Seyffarth's system, but Dr. Young's." "The rightful claimant is not Seyffarth, but Dr. Young." In this case, however, they were obliged honestly to confess and acknowledge that their "master" had unjustly condemned Young's discoveries. For the rest, my principle, as well as that adopted by the said *savans*, are, as we have seen, totally different from Young's theory. For I stated, that, in general, each of the 600 hieroglyphs expressed the consonants contained in the name of the hieroglyphic figure, and that all hieroglyphic texts must be explained, not symbolically, but syllabically and alphabetically; while Dr. Young taught that the syllabic hieroglyphs express consonants together with vowels, like *ole*, *eneh*, and that the hieroglyphic texts, except the proper names, consist of symbolic characters.

Further, "Champollion's disciples have been guilty of no apostacy, but have only followed their master's example in attributing syllabic values to other hieroglyphs." I do not know whether this assertion is contradictory to the preceding. Young being the first discoverer of syllabic hieroglyphs, everybody "attributing syllabic values to certain hieroglyphs" is Dr. Young's follower, not Champollion's; and, as Champollion's express direction is, to take no hieroglyph for a syllable, I ask, is "attributing syllabic values" to 200 hieroglyphic figures" apostatizing from Champollion's theory, or not?

Besides, "it is absurd to conclude, without further proofs, that one has borrowed from the other." "The whole syllabic theory was not stolen from Seyffarth or any one else, but was slowly elaborated, step by step, as the result of long (?) and patient (?) observation and induction." "Champollion left the science in so advanced a state, that his successors could not long have followed in his steps without admitting the existence of syllabic characters." "The progress from symbols read phonetically to that of syllabic characters is natural and, under the condition, inevitable." In answer to this argument, we submit the following inquiries: Supposing that the discovery of the said "key" was "inevitable," why is it that none of all the Champollionists, even the most able, as Rosellini, Ungarelli, Salvolini, Lenormant, De Saulcy, Leemans, Birch, Hincks, and others, had not made that "inevitable discovery" themselves? Why is it, that even Lepsius, Brugsch and De Rougé made that "inevitable discovery" simultaneously and not before 1845, and so short a time after copies of my syllabic Alphabet had come into their hands? Concerning that "slow, long and patient elaboration," it seems to me that an "elaboration" beginning with the end of 1849, and finishing, in 1851, with the publication of large volumes like Brugsch's Rosettana and De Rougé's "Tombeau d'Ahmes," is not at all a "slow, long and patient elaboration of the syllabic theory." The same is the case with Mr. Lepsius' long "elaboration," as we have seen. For the rest, every gentleman who makes a discovery, and subsequently sees, with his own eyes, that the same discovery was already made by another, feels bound to respect the other's discovery, and to mention it in order to prevent all reproach of plagiarism. Why is it, I ask, that those gentlemen did not do so, but ignored and reviled the author's researches? The fact remains indisputable, that none of the said Egyptologists as yet knew anything about my syllabic characters in their publications immediately preceding the edition of my syllabic Alphabet, but only after it. The pretended facility of the discovery proves as little as the egg of Columbus.

The Rev. P. Renouf makes an effort to justify M. de Rougé, especially, by a passage in the "Revue Archéologique" of 1848, where M. de Rougé says, "Lepsius states, 1st, an alphabet consisting of mere letters; 2d, syllabic characters, i. e., expressing a whole syllable." The absurdity of the theory of Lepsius, however, has already been exposed, and his discovery of syllabic characters had already been made 22 years previously to M. de Rougé's article in question, viz., in my Rudimenta, in all my subsequent publications, and even in my syllabic Alphabet, being three years older than the said passage. In short, the passage in question proves that M. de Rougé, in 1848, admitted syllabic hieroglyphs, known since 1826; but it does not at all prove that M. de Rougé has not "dishonestly availed himself," in his publication of 1851, of my syllabic Alphabet, of which a copy was in his possession, nor that he had not deserted Champollion's system.

Further, the apologist objects that "their Alphabet is not the same as his." The first book of Lepsius, however, published after my "key" and syllabic Alphabet—his Egyptian Chronology, Berlin, 1848—contains about 30 syllabic characters, nearly all expressing the same syllables which I had, three years before, ascribed to them in my Plates; while Lepsius, before that date, explained the very same hieroglyphs only symbolically or alphabetically, and, in part, very differently from my Alphabet. The first book of Mr. Brugsch published after my "key" and Alphabet—his "Inscriptio Rosettana," Berlin, 1851—contains a list of 122 syllabic figures, which, excepting Mr. Brugsch's mistakes, correspond exactly with my syllabic hieroglyphs. The first work of De Rougé, subsequent to my Alphabet, "Le Tombeau d'Ahmes," Paris, 1851, contains about 30 syllabic hieroglyphs, nearly all harmonizing with my syllabic Alphabet.* It is true that those learned Egyptologists ascribed to some hieroglyphs syllabic values differing from those in my Alphabet, but why? As they were not much acquainted with the Coptic, and were unable to translate many hieroglyphic passages, they supposed some figures to be incorrectly determined in my Alphabet; then, in order to obtain fitting syllabic powers from such hieroglyphs, they recurred to another group containing the figure in question, although aware that hieroglyphic groups picked out of the context are susceptible of a hundred different translations. It is on account of their wrong syllabic hieroglyphs that De Rougé, in his wonderful "Le Tombeau d'Ahmes," discovered a "fire-snake, *Amhehw*" ("narrabo etiam nomen anguis illius, qui in monte suo; *habitans in igne suo;* nomen ejus *Amhehw*); and, in another place, obtained the sense that the deceased, in the times of Moses, 1867 B. C., was seven times decorated with the "décoration de la valeur militaire à collier d'or." For that same reason, Mr. Brugsch has delivered so marvellous an explanation of the Rosettana, while Dr. Uhlemann's translation, strictly following my Alphabet, is correct. I pass by all those alphabetical hieroglyphs of mine which were also silently adopted by those gentlemen, and add only, that I recognize many of my dear children by means of certain liver-freckles with which they were born.

Finally, the able advocate of the impeached testifies thus: "it is preposterous to fancy that one is tempted to steal treasures of this kind." Indeed, this argument alone is decisive!

I do not wonder at the great Lepsius, who begins the Egyptian history before the Deluge and the day of Creation, whose name is to be seen engraved, in cubital letters, on innumerable monuments in Egypt, in the place of once venerable inscriptions, first effaced by his hand; for native virtues are not easily eradicated. And this Berlin Professor did, many years ago, publicly declare that he did not care about priority of discoveries; in other words, that he would steal another's property whenever possible. In the same volume, also, where he appropriates my "key" and Alphabet, he likewise discovered the "key" to the astronomical monuments of Egypt, in spite of my Astronomia Ægyptiaca, a large work in quarto, published sixteen years before, which, before him,

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* See, for these three works and their plagiarism, Leipziger Repertorium, 1849, Vol. II., p. 1; 1852, Vol. I., p. 26; 1853, Vol. 1, p. 155.

had first demonstrated that the Egyptians expressed the Planets by the figures of the 7 Cabiri, and the Signs of the Zodiac by their 12 great gods. The same friend of truth, as soon as I had published Hermapion's Translation of the Flaminian Obelisk, said publicly, that Hermapion's Obelisk had not been discovered by me, but by the great master, Champollion, although he knew that Champollion had been in Rome twice, and had examined, during six years, the engraved Plates of that Obelisk, and that finally Champollion's disciples had published a totally wrong translation of it. The same is the case with Mr. Brugsch, at Berlin, the very young but true scion of Lepsius, who once discovered the normal arithmetic figures which had been, nine years before, published in my Alphabeta Genuina, and the syllabic characters of the Demotic writing, of which the existence and values were also previously discovered and published by myself. That is natural, for "similis simili gaudet." I wonder, only, at that nobleman, Vicomte de Rougé, Champollion's successor in the Louvre, although he is the warm friend of Brugsch and Lepsius.

Our pious ancestors were so much averse to all kinds of literary robbery that they invented a peculiar name for it, viz., *plagiarism;* at present, things are changed, and the world has now so much improved in morals that an Academical Professor does not hesitate to advocate literary theft. He turns into ridicule the idea that those gentlemen, even if they had made the same discoveries, after me, "by their own investigations" (while the contrary is proved), were obliged to respect another's property, or, in his own words, "first, to make an act of homage to him as the lawful owner;" "to give him the glory of the invention (of the syllabic alphabet of the Egyptians)." I never have affected "homage" and "glory;" but I must confess, I feel bound, for my part, as long as I shall live, to protest against all sorts of literary theft, and to endeavor to preserve honesty in the scientific world, and to maintain that good old maxim, *suum cuique.* Those gentlemen, I say, were bound, as soon as they abandoned Champollion's fundamental rule, "no hieroglyphic figure expresses a syllable," and as soon as they copied my Alphabet, or rather "discovered by their own investigation" a number of syllabic characters which had previously been discovered, to avoid at least the *appearance* of plagiarism.

Indeed, the Rev. Professor Le Page Renouf, of the Catholic University of Ireland, instead of punishing that noble Trifolium, of which the leaf-stalk, the copula, extends to Dublin, ought to have been ashamed to advocate palpable plagiarism before the eyes of many hundred youths, who sooner or later will propagate the moral principles held by their master; and, in addition to that, to malign truths by the instrumentality of printers' errors which he had himself perfectly well recognized. "The receiver is as bad as the thief."

It will be asked, what may be the proper and real intention of that so unprovoked calumny? I do not know, and leave it to others to decipher this very intricate hieroglyph. Perhaps, however, the "prudent" Egyptologist of the "orthodox school" speculated thus:—As the system opposed to Champollion's has already discovered and explained the most important bilingual and other inscriptions, and enables every one familiar with the Coptic (except the Dublin Hieroglyphist) at last to translate entire Egyptian texts, the nimbus of the "great master," and the glory of the whole "orthodox school," runs the risk of being forgotten. Therefore, the best expedient is to kill off the fatal system, and, as far as possible, deform and defile it, that all eyes may be averted from the dead carcass. Then, it will be easy to understand that the immortal followers of Champollion were never "tempted to steal treasures of that kind;" it will be possible to transform the whole system of Champollion, insensibly, and "step by step," into the opposite one; and finally, by means of the so metamorphosed wrong system, to translate, "step by step," the whole Egyptian literature. And thus, of course, some greater glory would be reflected upon the head of the "great master," and upon all other members of the "orthodox school," without the disgraceful confession that the "great master" had failed to discover the real "key" to the Egyptian literature. At least, there is a beginning made already; for in the 4th No. of the Atlantis, the next after the article in question, the same author tells his readers—"In the last number of the Atlantis, I said that the idea of syllabic hieroglyphs was *first* suggested by Dr. Young, and not by Seyffarth," and that "Champollion, in 1810, had anticipated Dr. Young's rebus-theory" (this counterfeiting has been shown in its true light above); and in a few years, from all quarters the echo would have resounded—Look into the "Atlantis," where, as early as 1859, it has been clearly demonstrated that the syllabic values of all the 600 Egyptian hieroglyphs were not discovered by Seyffarth, but by Dr. Young, or rather by the "great master." Besides all this, the "orthodox school" of Dublin probably speculated thus:—Should the worst come to the worst, at least no calumny is fruitless; for *semper aliquid manet!*

Let it be so or not, at least it needs a great deal of dullness to believe that articles of that kind would succeed in realizing such hopes; for the world (the Lord be praised!) is still full of gentlemen, who see through, and abhor, all sorts of falsehood and imposition. Champollion's system, except a few letters, grammatical forms, and hieroglyphic groups, together with his method of explaining hieroglyphic texts, expired at the same moment in which my syllabic determination of all Egyptian hieroglyphs appeared, and it is idle to think of galvanizing a dead body into life.

Everybody can now see, in the subjoined Plates, with his own eyes, and without being misled by an *ignis fatuus*, what is the true nature of my system, and what is the "marvellous key" by which I spell and translate hieroglyphic inscriptions, and by which a great many texts, both bilingual and not bilingual, have been already explained.

All the matters spoken of in the preceding pages have been discussed *in extenso* in my Grammatica Ægyptiaca; and it is a pity that young Egyptologists, instead of learning Coptic and studying my Grammar, should force me, from time to time, to stop in my course to shake my club in defence of a helpless babe against the ravenous dogs that are continually barking at it. It is a pity that any one should consume his short life in criticising systems, instead of applying his wits to practical account, by translating entire Egyptian texts, and thus confirming or correcting the results of former labors.

As, however, the progress of Egyptian Philology depends upon a reliable system, and as only that key to the hieroglyphs can be true which correctly spells and translates entire Egyptian texts, the following expedient will probably be the best for coming to a decision.

I ask then, respectfully, the Rev. P. Le Page Renouf of Dublin to translate, in a reasonable manner, those very same Egyptian texts, according to Champollion's system. I have only to request him not to discover anew, "by his own investigations," the syllabic values of the hieroglyphic figures printed in my Grammar. The said specimens contain but 285 hieroglyphic words, and, at the same time, 240 syllabic figures, which, according to Champollion's system, are to be explained either symbolically, or alphabetically, or by the "marvellous key" of abbreviation.

Furthermore, I request the able Reviewer to publish this translation and explanation in that same "Atlantis," for the benefit of the readers of the article in question; and I am sure he will not decline my urgent request, since he knows what the word *calumny* means, and what its influence is in this department of science. Let him not have recourse to his inability, or any other pretext; for a man who is so well versed in hieroglyphic matters, and so able to judge systems, and who explains so ingeniously the hieroglyphic text in the Atlantis (No. IV., p. 335), is certainly also able to translate 285 groups according to Champollion's system, which "laid the solid foundation of the whole science of Egyptian philology." Besides, the whole "orthodox school," so much honored in this notable article, will, there is no doubt, be so grateful as to help him, particularly at Paris.

In case, however, he should not succeed in translating and explaining the said texts, in a satisfactory manner, according to Champollion's principles, Grammar, and Dictionary,—and should fail to publish the said translation in the next number of the "Atlantis," or elsewhere,—then I should ask the learned world to take the Rev. Reviewer for a gross and shameless calumniator. He disapproved of such "rather indecent expressions," already made use of, in a similar case, by Dr. Uhlemann; but Justice makes no difference between learned and unlearned impostors: she treats individuals according to their conduct.

Notice of a new species of PLATYCRINUS *and other Fossils, from the Mountain Limestone of Illinois and Iowa; being an extract from the Second Annual Report of the Illinois Geological Survey. By* A. H. WORTHEN, *State Geologist.*

PLATYCRINUS PRATTENI, n. sp.

Platycrinus planus, (in part) of Owen and Shumard, Geol. Rep. on Wisconsin, Iowa, and Minnesota, by D. D. OWEN. Pl. V. A., Fig. 4.[b]

Calyx large with an entirely smooth surface, the base forming a deeply widened pentagonal cup. The articular surface by which it adheres to the last joint of the column is unknown, being covered by a joint of the column itself. The upper edges of the basal cup are very thin and overlap the the lower edges of the radial plates. These edges have a ragged or notched outline, caused by a series of grooves in the surface of the upper portion of the basal plates. At each angle of the pentagon, there is a large inflated projection, proceeding upward from the basal plates of which they form a part, and resting against two of the first radials, and seem to have been formed mainly to strengthen them after the manner of buttresses.

The first radial plates are slightly elongated, and are widest at about two thirds the distauce from their inferior to their superior borders, so that the calyx in passing upward narrows in again from this point, except the centre of each piece, which is so thickened for the reception of the second radial and to bear the weight of the arm, that it still preserves the calyx of the same diameter. The inferior angles of these pieces appear slightly truncated, from their not entirely meeting under the buttress-like projections of the basal plates.

On the lower surfaces of the radial plates and the upper surface of the basal plates, there are tooth-like projections fitting into each other like the sutures of a skull. The lateral edges of the radial plates have also a series of small teeth entering into depressions of the opposite radial piece, but these are so small as only to be seen with a lens.

The articular surface for the reception of the second radial is of an elliptical form, with a depth equal to one-half its width and at right angles to the surface of the second radial, and on its outer edge it is marked with a series of small teeth-like striæ.

There are three joints of the column attached to the specimen figured, and these are exceedingly thin; the two nearest the summit are round, the third one elliptical, much smaller than the others, and bears radiating striæ on its outer margin, which the others do not. The perforation in the centre is round and very small. The second radials, anal plates, interradials, vaults and arms, are all unknown. All the known plates are exceedingly thin.

Dimensions.—Length of calyx 40 millimetres, diameter 45. Length of first radial plates 27 mill., width 22. Diameter at the upper edge of the basal cup 32 mill., height of the basal cup to the centre of each side 15 mill., height of same to the top of its projections at the angles 21 mill.

Relations and differences.—This Platycrinus differs from all known species in its greater size, but more especially in the projections at the angles of the basal cup, and by its peculiar form of joint by which its basal and radial pieces are united. The teeth on the lateral edges of its radial pieces will also serve to distinguish it from any known species.

Geol. Position and Locality.—From the brown Crinoidal beds, near the base of the Mountain Limestone series, Burlington, Iowa.

I take pleasure in dedicating this magnificent species to its discoverer, my lamented friend Mr. Henry Pratten, who first pointed out the distinctive characters which separate this species from the *P. planus*, with which it has heretofore been confounded.

Productus Cestriensis, n. sp.

Productus elegans, Norwood and Pratten, Trans. of the Philadelphia Acad. of Nat. Sciences, August, 1854. Pl. 1, Fig. 7, a, b, c.

This very characteristic form of the Chester Limestone was described by Messrs. Norwood and Pratten in 1854, under the name of *Productus elegans*; but as that name was already appropriated by Prof. McCoy* to designate a British carboniferous species, it becomes necessary, in order to avoid confusion, to give it another name. I propose for it the above

*See McCoy's Synop. of Carb. Foss. Ireland, Pl. 18, Fig. 13; also, British Paleozoic Fossils, by Sedgwick and McCoy, page 460, Pl. 3 H, Fig. 4.

name, because it is one of the most characteristic Brachiopods of the Upper Archimedes or Chester Limestone, and is found in the greatest abundance at the typical locality, Chester, in Randolph County, Illinois.

CHONETES ILLINOIENSIS, n. sp.

Chonetes Logani, Hall; Iowa Report, Part II., page 598, not of Norwood and Pratten.

The Chonetes above named, which has been referred by Prof. Hall to *C. Logani* of Norwood and Pratten, is not only very different in its specific characters from the true *Chonetes Logani*, but holds an entirely different geological position. It is restricted to the Crinoidal beds of the Mountain Limestone, while the *C. Logani* belongs to the Oolitic member of the Chemung group. When *C. Logani* was described by Messrs. N. and P., they referred all the beds exposed at Burlington, Iowa, to the Mountain Limestone series, and hence the error in relation to its true geological position.

C. Logani has "about thirty rugose ribs" and three or four tubes on each side of the beak, while our species has from "one hundred to one hundred and twenty-five rounded dichotomizing striæ on its surface," and "five or six oblique spines on each side of the beak." Our shell is also more than twice the size of *C. Logani*. It is abundant in the white limestone at Quincy, Illinois, where the original specimens were obtained.

Fourth Series of Descriptions of BRYOZOA *from the Palæozoic Rocks of the Western States and Territories. By* H. A. PROUT, M.D.

COSCINIUM WORTHENI, n. sp.

Polyzoum a leaf-like expansion, with a zig-zag midrib elevated much above the declining sides of the expansion, having lateral branches given out at its salient points, which are likewise raised above the declining surfaces proceeding from it, and which, as they proceed downward, change at right angles the original planes of expansion. Dimples long, elliptical; longitudinal diameter five to seven and one half; transverse, one to one half mm., oppositely pinnate both on the branches and midrib, about four mm. apart. Cells large, about four longitudinally or transversely in the space of two mm.; lips round, thickened on the lower border but not distinctly nasiform; direction of the cells, slightly upward and outward to the plane of the surfaces from the midrib, being only slightly modified by the elevation of the lateral branches. Intercellular spaces, or net work, minutely capillary, as this tissue is developed from the approximating and receding ridges of the sole.

Geological position and Locality.—Keokuk or first Archimedes Limestone, near Warsaw, Ill. Illinois State Collection, No. 1.

This species we dedicate to Mr. A. H. Worthen, State Geologist of Illinois, whose indefatigable labors in the field, and whose zeal and devotion to the interests of the science, promise a rich harvest to Western Geology. Through his kindness and liberality we have been permitted to describe this beautiful species, together with many other forms of Bryozoa belonging to the Illinois State survey, which we have in MSS.

Coscinium elegans, n. sp.

Polyzoum a leaf-like expansion between what seems to be a wide bifurcation of the midrib, rythmical dimples from each branch pointing at first obliquely toward each other, meeting irregularly toward the middle, and anastomosing toward the superior border, which is reflected upon itself by compression. Dimples small, sharp and pointed, sometimes long; longitudinally or transversely, there are from five to six in a space of twenty mm. *Cells* large, almost visible to the naked eye, with prominent rounded lips, on the border of the dimples they seem larger and give to it a notched appearance.

Geological position and Locality.—Warsaw or second Archimedes Limestone, Warsaw, Illinois. No. 2, Illinois State Collection.

Though the measurements in this species are very nearly the same as in the *C. Keyserlingi*, we are inclined to refer it to a distinct species, from the narrower, longer and more pointed dimples which are lanceolate, while in the *C. Keyserlingi* they are broader and more oval; this, together with the difference in the surface distribution of the dimples, will, we believe, warrant the distinction.

Coscinium plumosum, n. sp.

Polyzoum an irregular leaf-like expansion, midrib sharp, crust-like, raised irregularly above the surface, more or less alternately branching, the spaces between the branches being more or less concave, and rising upon their outer borders to be united with other concave expansions from other branches. Where the expansions are large, the long narrow rythmical dimples, and corresponding ridges between them, are sometimes curved like long plumes, gracefully waving over one another, but the distribution of the dimples is mostly irregular, from the irregular growth of the polyzoum. In one specimen belonging to my own cabinet, the opposite face of the polyzoum is broken up into cup-shaped cavities about the size and shape of those which characterize the *Michelinia favosa* (Kon.)

These cup-shaped cells are bounded by insterstitial plates, with thin, salient and entire lips, denuded of chalices near the margin, and are marked by rythmical and abortive spaces, occasionally, toward the centre. Sometimes this cupuliferous expansion is found separate from the wider and more plumose form of the polyzoum, and would by those who are not careful in distinguishing forms be most probably referred to *Michelinia.*

Geological position and Locality.—Warsaw Limestone, second Archimedes group, Warsaw, Illinois (Illinois State Collection, No. 3), and Barrett's Station, St. Louis County, Missouri.

COSCINIUM MICHELINIA, n. sp.

Polyzoum encrusting, extending over a considerable surface, divided into larger or smaller more or less hexagonal cup-shaped cavities, with salient tuberculated lips, bottoms of the cups having sometimes deep lanceolate, or oval depressions; interior surfaces marked with irregular ridges covered by cell pores or chalices, leaving occasional abortive spaces betweem them.

We separate this from the preceding species on account of its more robust growth, the irregular notched or tuberculated form of the lip, and the other characters assigned to it above. The thin and salient lips of the Plumosa would scarcely assume the tuberculated form in a regular development of the polyzoum.

Geological position and Locality.—Warsaw Limestone, or second Archimedes, Warsaw, Illinois. Illinois State Collection No. 4.

COSCINIUM SAGANELLA, n. sp.

Polyzoum expanding and encrusting, cell divisions very long, more or less irregularly hexangular, border of the septæ not so acute as in *C. plumosum.* We have provisionally separated this from the two species above, until we are enabled to procure more perfect specimens. Named from its resemblance to *Saganella* (Hall).

Geological position and Locality.—Warsaw Limestone, or second Archimedes, Warsaw, Illinois. Illinois State Collection, No, 5.

COSCINIUM TUBERCULATUM, n. sp.

Polyzoum an expansion somewhat concave and broadly recurved toward one margin; tuberculations more or less irregularly arranged in lines, with rythmical dimples marking their summits; those toward the upper border are not dimpled, and are still covered with chalices. Dimples oblong oval; in a space of twenty mm. there are three to four in perpendicular, and four in oblique lines. The mammillation is more crowded towards the upper border' than near the central and lower parts of the expansion. We were at first disposed to regard this as an irregular form of the *C. Keyserlingi*, but the arrangement of the dimples on the summits of the mammillæ, and the existence of mammillary swellings instead of an irregularly waved surface, will, we believe, sufficiently distinguish them from one another.

Geological position and Locality.—Keokuk Limestone, or first Archimedes group, near Warsaw, Illinois. Illinois State Collection, No. 6.

Coscinium asteria, n. sp.

Polyzoum a thin, irregular encrusting expansion, covered with small chalices, except at certain points, which have the appearance of oblong, radiating, or substellar markings formed of more prominent lines of chalices, with narrow abortive spaces between them. These substellar dimples are more or less irregular in form, the rays being sometimes unduly prolonged, but are somewhat regularly arranged in relation to one another, being more or less quincuncial in their distribution. The distance between the substellar points is in general about 5 mm.

Geological position and Locality.—Keokuk Limestone, or second Archimedes group, near Warsaw, Illinois. Illinois State Collection, No. 7.

Coscinium escharense, n. sp.

Polyzoum a flat expansion most probably encrusting, covered with small chalices except at rythmical points, where the very shallow dimples seem to have denuded the surface. These scars are somewhat irregular in form and distribution, but are mostly oblong-oval in shape. This is no doubt a beautiful species, but the specimen from which this description is drawn is too small and imperfect to give us a full view of all its characters.

Geological position and Locality.—Keokuk Limestone, or second Archimedes, near Warsaw, Illinois. Illinois State Collection, No. 8.

Cyclopora, nov. gen.

Polyzoum discoidal, frondescent, or irregularly encrusting plates sometimes superposed, with sub-prismatic chalices longer than broad, having their sides formed of a minutely porous interstitial net-work, developed from a sole marked by trans-bands or wrinkles more or less concentric, sometimes intercurrent or contorted, which are crossed at right angles by delicate, slightly interrupted lines separating the bases of the chalices and radiating to an actual or imaginary centre, almost as regularly as the hymenium of a mushroom, or the plates of a *Fungia*, without being, like these, entire in their vertical expansion; chalice apertures, on one or both faces; more shallow and expanded, with interstitial spaces more porous and net-like than in *Chætetes*

We have been induced from the considerations which follow, to separate this genus from the *Ceriopora* of Goldfuss. This genus, though well defined by its author, was rendered by its terms too comprehensive, and embraced within its limits too large an assemblage of heterogeneous forms. Many of these have been transferred by subsequent writers to other genera, and M. D'Orbigny has more recently excluded from its limits all expansive or encrusting forms, restricting it to such as are ramose, having one or many layers of cells superposed upon one another, which includes in part the *Inversaria* of Hagenow. We do not feel disposed to admit this mere modification in the growth of the polyzoum, taken separately and alone, as an adequate basis for generic distinction; for it is well known that the superposition of layer upon layer may be the result of age, and we have observed several times in our investigations, that the expanding and encrusting forms may gradually assume the ramous or convolute modes of growth. On reflection, it will be readily perceived how these accidental modifications of form may be developed, for the approximating borders of an expansion may fail to meet each other in exact apposition, and the convolute form be induced, or an excess of development at certain points on the surface or the margin of the polyzoum may give rise to the ramose forms,—or, if this latter should be arrested, to a simple tuberculation of the surface.

It will be readily inferred from these observations, how much difficulty attends the correct classification of this order of the animal kingdom, in which the generic and specific characters are so extremely limited. If we leave out of consideration external forms, which are so invariable and definite in the higher orders of animal life, and search into the minute anatomical elements of their organization, we scarcely feel more secure in our distinctive determinations; for when these are profoundly investigated, and viewed in all their relations, they seem but modifications, gradually taking their origin in a common type, as with the Anthozoa, modified as it is into all the beautiful and diversified forms which it presents.—We are enabled to ground our groupings into families and genera, only on developments, when not accidental, which result from the plastic calcareous or corneous secretions, and the form and general arrangement of the cells or chalices; while for specific distinctions we are restricted to narrower limits, or, to indicia of minor importance, such as the relative size and form of the cells, their number and distance apart, and sometimes to phenomena of a purely negative character.

These principles, when more accurately defined and limited to their proper sphere, may lead to a more correct classification, or a more natural arrangement of the Polyzoa than those which have been previously proposed. It must be admitted that the present classification is almost as defective in Polyzoology, as when the profound and gifted mind of D'Orbigny essayed to establish order where the wildest confusion had previously prevailed. In all deference to his genius and his labors, which are worthy of all praise, we are compelled to believe that he has given too great an expansion to many parts of his system, by the multiplication of genera in the different groups, and has sometimes associated forms, which have no generic affinities, from losing sight of the terms or the characters on which his distinctions were founded. Those who fully comprehend the difficulties of a correct classification of these often minutely developed forms of living beings will regard with proper indulgence these errors in an attempt to restore order where nothing but the most indiscriminate complexity had formerly existed. In attempting to make our descriptions conform to a strictly natural system, we are not certain that we shall meet with greater success. All that we can promise is to adhere strictly to this basis of classification, having full faith that principles grounded in nature, fully comprehended, and properly interpreted, cannot very far mislead the earnest and humble enquirer after truth. We hope by our labors to remove some of the difficulties which oppose themselves to a better understanding of the zoological and palæontological value of this beautiful and interesting, but hitherto much neglected, order of fossil forms.

The genus established above is one which embraces several discoidal and encrusting forms. The concentric, more or less banded basis or sole, which from its thickening into folds, or ridges, gives more strength and firmness to the net-work, in which the tiny workers above were implanted, sufficiently distinguishes it from the *Semicoscinium* with its more or less lamellar and condensed intercellular spaces, and its sole condensed in parallel ridges; from the *Coscinium* with its raised chalice lips, and its sole formed of approximating and receding ridges; or from *Chætetes* with its more condensed intercellular spaces, and its longer tubes, which take their origin in an uncondensed cellular or cancellous structure. The basis of its separation from its congeners of the same group, is founded mainly upon the form and character of its sole.—This banded arrangement of the condensed base seems to be represented in *Ceriopora verrucosa*, Gold., Tab. X, Fig. 6, c., which most probably belongs to this genus. Now it may be said, that where the general characters and the arrangement of the chalices are nearly the same, the distinctions in the form of the sole possess little or no generic value: but this objection can have but little force, unless it can be proved that these differences in the character of the basal plates, and the direction and distribution of the chalices which impressed these forms upon them, were accidental, and not strictly the result of differences in the laws which regulate the definite development of organic forms.

CYCLOPORA FUNGIA, n. sp.

Polyzoum a flattened disk about two inches in diameter, with a central depression on the lower surface, and a somewhat irregular margin; striæ or sole-lines radiating from the centre, somewhat whorled at first, delicate, interrupted, or jagged, being *apparently* formed of long, slightly waved, septate, flattened tubes in juxta position on a common plane of expansion; concentric rings more or less rugosely plicated, and marked by depressions, which seem to have resulted from abortive cells larger than those which formed the radiating striæ. As the annulations become more prominent toward the border, the striations become less distinct and more irregular.

Chalices only seen upon the upper face by grinding the lower surface, where they appear to be round or subprismatic, longer than broad, vertical in direction, alternately juxtaposed in radiating lines, with no sheaths distinct from the plexiform interchalicular spaces, which are formed by the union of minute cells varying in size and development.

Geological position and Locality.—Keokuk Limestone, St. Francisville, Mo. Collection of A. H. Worthen, No. 9, (a.)

At first we were disposed to refer this species to the genus *Fungia*, as in general appearance it resembled very closely some of the discoidal forms of this coral, more particularly the *Fungia discoidea*, Gold., Tab. XIV., Fig. 9, a. But a minute examination of its structure rendered it manifest that it was a true polyzoa, allied somewhat on one side to *Ceriopora* (Gold.), and on the other to *Chætetes* (Fisch), from the latter of which it is separated by the existence of a sole, and the comparative shortness of its chalices. The chalices and the interchalicular spaces are not septate, but the same may be said of *Chætetes*, as we have found on careful examination, that the septæ in the forms submitted to examination are more imaginary than real, being caused by the breaking in of cells forming a part of the net-like interchalicular spaces.

CYCLOPORA DISCOIDEA, n. sp.

Polyzoum a flattened sub-convex, or sub-concave expansion with a central elevation; discoidal portion about two, or two and a half inches wide, with radiations distinctly marked, showing the basis of the chalices on the upper surface in connected lines and alternate series. Margin irregular, running into irregular frondescent expansions, which still preserve the concentric form of the banded sole. One specimen is so deeply concave as to become infundibuliform; chalices only on one side, larger and not so long as in *C. fungia.*

Geological position and Locality. — Keokuk Limestone, near Warsaw, Ill. Illinois State Collection, No. 9, 10, 11.

CYCLOPORA POLYMORPHEA, n. sp.

Polyzoum a large encrusting expansion, with the ridges variously contorted without the appearance of a disk, although it seems to have had several centres of development. Chalices larger than in the two former species, with the interchalicular spaces more rugose; chalices on both faces, with evidences here and there of a disposition in the layers to superposition. The specimen from which this description is drawn is about four inches broad by as many long, and the whole expansion of the polyzoum seems to have been several times as broad as the space comprehended by these measurements. It is, we think, evidently specifically different from the two preceding forms.

Geological position and Locality.—Chester Limestone, or 3rd Archimedes Limestone, Pope County, Ill. Illinois State Collection, No. 12.

CYCLOPORA JAMESII, n. sp.

Polyzoum a fragment showing mostly the sole with chalices superposed upon both faces on certain parts of the specimen; sole formed of more or less concentric ridges, bent or erratic at times, crossed by delicate striæ or lines, the intervals between which appear like long septate parallel flattened tubes, the apparent septæ marking the origin of the chalices; intersections of the ridges and striæ mostly at right angles; chalices or net-work of chalicular apertures almost regularly quadrangular, somewhat more delicate and condensed where worn than the preceding species, from which it is furthermore distinguished by rythmical swellings upon the surface, or light tuberculations upon which the chalices are larger and more irregular in form; number of chalices in a space of two lines square, about 100.

Geological position and Locality.—Blue or Trenton Limestone, Cincinnati, Ohio. We are indebted to the kind liberality of Mr. U. P. James of Cincinnati for this beautiful species. It must have belonged to a specimen from at least 4 to 6 inches in length and width, as the concentric ridges upon it are so gently curved as to show a great relative distance from the centre.

SEMICOSCINIUM ERIENSE, n. sp.

Polyzoum a leaf-like expansion covering one entire face of a mass of sub-crystaline limestone, three inches long by two inches broad, with the sole weathered below the anastomosing lines of cells, and exposing only a back view of the medallion face. The quincuncially arranged oscules seem to have a parallel penniform distribution with the points of the barbs coalescing, but without distinct rachides or shafts. This arrangement is obvious to the naked eye toward the base and middle portion of the bryozoum, but is less distinct toward the borders. *Fenestrules* not so large as in *S. rhomboideum*, oval, somewhat irregular in size, with pore-like chalices filling their depressions and irregularly planted upon their interstitial net-work. Whether the plume-like distribution of the oscules is preserved on the medallion face could not be determined, as we were able to invert only a small portion of it.

This beautiful but imperfect specimen was presented to us by Mr. U. P. James of Cincinnati, Ohio, and is from Cunningham Island, Lake Erie. Devonian (?).

SEMICOSCINIUM TUBERCULATUM, n. sp.

Polyzoum a broad encrusting expansion, marked with low ranges of tubercles, disposed quincuncially, about two lines apart when measured in rectangles, about three in diagonals.

Fenestrules round, sometimes quadrangular in form, much smaller than in the preceding species, and much more irregular in their distribution, as if disturbed by the elevation of the mammillæ, which are rythmically arranged upon the surface; chalices or proliferous cells minute, placed very irregularly upon the interstitial net-work, and imperfectly filling the oscules.—In this specimen the approximating and receding lines of cells, which appear as tortuous tubes in the *S. rhomboideum*, are not so apparent, and the basal ridges are more or less variously contorted, so as to lose their parallelism to a great extent. The similarity of its structure and its general characters associate it very closely with the species previously described.

Geological position and Locality.—Devonian, Falls of the Ohio. In the Collection of Dr. B. F. Shumard.

POLYPORA HALLIANA, n. sp.

Polyzoum a broad fan-shaped expansion, with apparently entire rigid longitudinal rays radiating from a central point, with fenestrules obvious to the naked eye.

Longitudinal rays regular, on a plane of expansion only slightly waved without folds or plications, round, straight or direct bifurcating nearly oppositely near the base, about two lines near the middle, about four and not so frequently towards the border.

Dissepiments mostly alternate, small, depressed, often not much more than connecting points between the longitudinal rays; about one-fourth as long as the fenestrule, and somewhat expanded at their junction with the longitudinal rays. Owing to their depression the spaces between the rays appear as long furrows, somewhat notched.

Fenestrules long, oval and narrow, being from twice to three times as long as broad. Two longitudinally in a space of two lines, three transversely.

Chalices small, pore-like, juxtaposed in sinistral spiral lines upon the longitudinal rays; about four lines of alternate chalices and sometimes five, rarely three toward the base. In straight lines there are about four to each fenestrule, in zigzag, eight to nine.

Comparisons.—Resembles *P. Mexicana*, but differs by the want of contraction and expansion above and below the bifurcations, in the fewer number of chalices upon the borders of the fenestrules, and in the general form of the bryozoum.

Geological position and Locality.—Second Archimedes or Warsaw Limestone, Warsaw, Ill. Illinois State Collection, No. 13.

POLYPORA GRACILIS, n. sp.

Polyzoum a long narrow net-work, proceeding from a pedicle, with longitudinal rays of nearly uniform size, appearing to branch much more frequently toward the margin than near the base.

Longitudinal rays round, dilating very slightly at the bifurcations, spaces between the bifurcations long, lanceolate, dichotomizations from two to five lines apart, but on parallel rays nearly opposite.

Dissepiments very small, expanded at their junction with the longitudinal rays, dividing them into a somewhat irregular net-work.

Fenestrules long, oval, but sometimes quadrangular, about as broad as the large longitudinal rays.

Chalices in lines alternately distributed with calcareous raised lips when perfect common to the chalice openings, which are sometimes depressed at certain points, or elevated by the expansion of the cells forming the substance of the longitudinal rays; four to five lines of chalices on each ray, mostly dextral; about fifteen to twenty to each oscule, with no interjacent lines of very minute pores between them; when the longitudinal rays are worn they appear minutely tubular striate.

Reverse long-tuberculate, anfractuous, with occasional small pores.

Comparisons—This very large and graceful species of *Polypora* is allied somewhat in character to the *Retepora laxa*, Phillip (*Polypora*, McCoy; *Gorgonia ripisteria*, Gold. VII., Fig. 2), but differs from it in being much larger in branching more regularly, in having no interjacent lines of pores between the chalices, and in the long ovate form of its oscules.

Geological position and Locality.—Second Archimedes Limestone, Warsaw, Ill. Illinois State Collection, No. 14.

Observations upon the CRETACEOUS STRATA *of Texas, by* B. F. SHUMARD, M.D., *State Geologist.*

In the present communication I propose to submit to the Academy a descriptive section of the Cretaceous Rocks of Texas in so far as they have been determined by the Geological Survey.

The importance of this system in the Geology of our State has led us to investigate very carefully its various subdivisions, with the view of determining as accurately as possible their stratigraphical relations and the fossils characteristic of each group. We have devoted special attention to the inferior division of the system, which includes beds that, previous to the commencement of our survey, had yielded but a meagre list of fossils, and which have been the subject of much controversy, some authors assigning them to the Jurassic and Triassic Periods, while others, and by far the largest list of authorities, have referred them to their true age—the Cretaceous. Although much has been written concerning the upper or calcareous portion of our Cretaceous System, and many of the fossils have been described by Roemer, Conrad, Morton, and others, the subdivisions have not hitherto been recognized, and yet the fossils of the superior layers are quite as distinct from those of the middle, and these again from those of the lower beds, as are the fossils of any of the recognized subdivisions of the Carboniferous System of the Mississippi Valley. In fact, we have found that most of the fossils of the Upper Cretaceous have a very limited vertical range, and that only a single species, the *Gryphæa Pitcheri*, has been ascertained to extend from the base to the summit of the mass. Not a single species has been discovered ranging from the Lower into the Upper Cretaceous.

The order of succession and thickness of the different members of the Cretaceous system, so far as observed in Texas, are expressed by the following section, which is believed to be in the main correct, although it is not improbable that further researches may render some slight modifications necessary:

SECTION OF THE CRETACEOUS STRATA IN TEXAS.

	Subdivisions.	Feet.	Characteristic Fossils.	Eq. Nebraska Section.	Eq. Alabama Section.	Eq. Pyramid Mt. Sec.
Upper Cretaceous or Calcareous Division.	Caprina Limestone.	60		Wanting.	Wanting.	Wanting.
	Comanche Peak Group.	300 to 400	Exogyra Texana, Gryphæa Pitcheri, Janira occidentalis, Cardium multistriatum, Lima Wacoensis, Ammonites Pedernalis, Natica Pedernalis, Heteraster Texanus, Holectypus planatus, Cyphosoma Texana, and Diadema Texana.			
	Austin Limestone. Fish-bed.	100 to 120	Gryphæa vesicularis, Exogyra costata, Radiolites Austinensis, Nautilus Dekayi, Baculites auceps. Fish remains—Mosasaurus.	Nos. 4 & 5 (?)	A B C	
	Indurated Blue Marl.	60	Exogyra arietina, Dentalina.	No. 3.	Wanting.	E F G
	Washita Limestone.	100 to 120	Gryphæa Pitcheri, var. Tucumcarii, Ostrea subovata (O. Marshii, Marc.), O. carinata, Inoceramus problematicus, Hamites Fremonti.			
	Blue Marl.	50	Inoceramus problematicus, Ostrea, &c.	No. 2.		
	Caprotina Limestone.	55	Orbitolina Texana, Caprotina Texana, Natica acutispira.			
Lower Cretaceous.	Arenaceous Group. .... Fish-bed.	80	Ostrea bellarugosa, Cyprina(?), Fish remains.	No. 1.	E	B C D
	Marly Clay, or Red River Group.	150	Ammonites Swallovii, A. Meekianus, Ancyloceras annulatus, Scaphites vermiculus, Baculites gracilis, Gervilia gregaria, Inoceramus capulus, Fossil Wood.			A

I now proceed to describe the divisions of the System in the order laid down in the above section.

I.—Upper Cretaceous or Calcareous Division.

This division, in the eastern or settled portion of the State, attains a thickness of from 800 to 1000 feet, but in its western extension reaches a much greater development. It presents the following subdivisions from above downwards: *Caprina Limestone*, *Comanche Peak Group*, *Austin Limestone*, *Exogyra arietina Marls*, *Washita Limestone*, *Inoceramus problematicus Beds*, and *Caprotina Limestone.*

Caprina Limestone.—This is the uppermost recognized member of the series, and, although of no great thickness, has a somewhat extended geographical range. It is a yellowish-white limestone, sometimes of a finely granular texture, and sometimes made up of rather coarse, subcrystalline grains, cemented with a chalky paste. It generally occurs in thick massive beds, and is capable of withstanding the action of the weather to a greater extent than most of the members of the Cretaceous System. This formation is usually found capping the highest elevations, and its presence may be nearly always recognized, even at a distance, by the peculiar flat-topped and castellated appearance it imparts to the hills. According to Dr. Riddell, it is finely displayed along the bluffs of Brazos River in Bosque, McLennan and Hill Counties; also, along the Leon and Bosque Rivers. The summits of the remarkable elevation known as Comanche Peak, in Johnson County, and that of Shovel Mountain, in Burnet County, consist of this rock.

The fossils are chiefly *Caprina*, *Cytherea*, and *Ammonites*, of undetermined species.

Comanche Peak Group.—The *Comanche Peak Group*, which next succeeds in descending order, is an important member of the series, and presents a greater development, both horizontally and vertically, than either of the others. It is made up of soft, yellowish and whitish chalky limestone, and buff and cream-colored limestones of greater or less compactness. The following section, taken by the writer, assisted by Dr. Riddell, at Shovel Mountain, in Burnet County, will convey a pretty good idea of the general lithological features of the mass:

No. 1.	Caprina Limestone	68 feet.
" 2.	Buff calcareo-magnesian limestone	20 "
" 3.	Soft, chalky limestone, abounding in Exogyra Texana	20 "
" 4.	Light, gray, hard, silicious limestone	5 "
" 5.	Light yellow, earthy limestone, of sandy texture	10 "
" 6.	The same, but of a lighter color	10 "
" 7.	The same, more compact in texture	19 "

No. 8.	Slope with beds of yellowish, soft, coarse-grained limestone, projecting at intervals. Some of the layers are more or less silicious	77 feet.
" 9.	Slope	10 "
" 10.	Light yellowish earthy limestone, appearing at intervals from slope	87½ "
" 11.	Light cream-colored, subcrystalline limestone	8 "
" 12.	Slope	15 "
" 13.	Very similar to No. 11, but of a more granular texture	8 "
" 14.	Light, yellow, soft, chalky limestone, abounding in Gryphæa, Rostellaria and Arca	44 "
" 15.	Same as No. 13	8 in.
" 16.	Light yellowish, sandy and compact limestone, projecting in benches from slope	69 feet.
" 17.	Rough, earthy, silicious limestone	5 "

The best exhibitions of this formation that we have seen are at Comanche Peak, Shovel Mountain, and at Mount Bonnell, near Austin.

Fossils.—This group is remarkably rich in organic remains, a large proportion of them, however, occurring usually as casts. The species most frequently observed are: *Exogyra Texana*, *Gryphæa Pitcheri*, *Janira occidentalis*, *Cardium multistriatum*, *C. Texanum*, *C. Coloradoense*, *Pholadomya Sancti-Sabæ*, *Lima Wacoensis*, *Arcopagia Texana*, *Trigonia crenulata*, *Astarte lineolata*, *Cardita erminula*, *Corbula occidentalis*, *Modiola concentrice-costellata*, *Leda*, *Thracia*, *Ammonites acuticarinatus*, *A. pedernalis*, *Scolaria Texana*, *Phasianella tumida*, *Rostellaria* (*Eulima*, Sh.) *subfusiformis*, *Natica pedernalis*, *Nerinea acus*, *Avellana Texana*, *Turritella seriatim-granulata*, *Cerithium Bosquense*, *Pleurotomaria* (undet. sp.), *Solarium* (undet. sp.), *Heteraster* (*Toxaster*, Roe.) *Texanus*, *Holectypus planatus*, *Cyphosoma Texanum*, and *Diadema Texanum.*

It is quite probable that this and the preceding subdivision of our Cretaceous System are not represented in Nebraska. We have collected more than fifty species of fossils from these beds, and not a single one has been found identical with any of the numerous Nebraska forms that have been described by Messrs. Meek, Hayden, Hall, the writer and others. Neither have we seen any palæontological evidence that the beds under notice are parallel with any of the members of the New Jersey and Alabama series, though it is not improbable that a closer study of the Cretaceous rocks in Alabama will show them to exist there.

Austin Limestone.—This subdivision consists of cream-colored and bluish earthy limestone, and resembles in lithological features portions of the preceding group, but contains quite a different assemblage of organic remains. Some of the beds are soft, and crumble readily upon exposure, while others are moderately hard, and furnish a handsome building rock, which may be cut into almost any required shape with a common hand-saw. The State House and several of the public buildings at Austin are constructed of this stone. This formation occurs at Austin, and near San Antonio and New Braunfels. Dr. Riddell also recognized it in McLennan and Bosque Counties, and Dr. G. G. Shumard in Grayson County. The greatest thickness observed is in the vicinity of Austin, where the beds are exposed to the height of about one hundred feet.

Organic Remains.—The most characteristic are *Inoceramus biformis*, *Gryphæa vesicularis*, *Exogyra costata*, *Ostrea anomiæformis*, *Arca vulgaris*, *Radiolites Austinensis*, *Nautilus Dekayi*(?), *Baculites auceps*, *Helicoceras*, *Ammonites*, *Cassidulus æquoreus*, *Hemiaster parastatus*, and scales and teeth of fishes.

At the base we have shaly layers of dark bluish-gray, calcareous sandstone, containing numerous fish-scales, teeth of *Corax heterodon*, *Lamna Texana*, and remains of *Mosasaurus*.

This assemblage of fossils establishes pretty clearly that the Austin Limestone represents divisions A, B and C, of the Alabama Section, as determined by Prof. Winchell,* which are regarded by Messrs. Meek and Hayden, and Prof. Hall, as on a parallel with Nos. IV. and V. of the Nebraska Section.

Exogyra arietina Marl.—This is an indurated blue and yellow marl, with occasional bands of gray limestone, and thin seams of selenite interstratified. It contains iron pyrites in the form of small spherical masses, and the fossils are also frequently studded with brilliant crystals of this substance. It is well exposed towards the base of Mt. Bonnell, near Austin, where it presents a thickness of about sixty feet. It may also be seen to advantage near New Braunfels, in Comal County, at various points in Bell County, and Dr. G. G. Shumard found it resting upon the limestone of Ft. Washita, in Arkansas.

Fossils.—*Exogyra arietina*, *Gryphæa Pitcheri*, *Janira Texana*, and a small undescribed species of *Dentalina*. On Shoal Creek, near Austin, *Exogyra arietina* occurs in the greatest profusion, the surface of the ground being sometimes literally covered with them.

Washita Limestone.—This important member of our Cretaceous System is made up of a nearly white, yellow, gray and blue limestone, some of the layers being moderately hard, while others disintegrate rapidly from exposure. This

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* See Remarks on the Tertiary and Cretaceous Formations of Nebraska, by F. B. Meek and F. V. Hayden, Proc. Ac. N. Sci., Phil., for May, 1857. Also, Notes on Geol. of Alab., by A. Winchell, Proc. Amer. Assoc., Montreal Meeting.

formation is exhibited at many localities in the State. Good exposures occur near Austin, and in Grayson, Fannin and Red River Counties. According to Dr. G. G. Shumard, it is finely developed at Ft. Washita.

Fossils are extremely abundant in this formation. The most common are *Holaster simplex*, *Epiaster elegans* (*Hemiaster elegans*, Shum., and *Toxaster elegans*, Conrad and Hall), *Cidaris hemigranosus*, *Gryphæa Pitcheri*, (common var. and var. *G. Tucumcarii*), *G. sinuata*, Marcou (not Sowerby), *Ostrea subovata* (*Ostrea Marshii*, Marcou), *O. carinata*, *O. quadriplicata*, *Janira Texana*, *Janira Wrightii*, *Inoceramus problematicus*, *Pachymya Austinensis*, *Lima crenulicosta*, *Terebratula Wacoensis*, *Turrilites Brazoensis*, *Ammonites Texanus*, *A. Brazoensis*, *Hamites Fremonti*, and *Nautilus Texanus*.

The occurrence of the well known fossil, *Inoceramus problematicus*, in the formation we are considering, places it on a parallel with the lower part of No. 3 of the Nebraska Section of Messrs. Hall, Meek and Hayden, while the presence of *Ostrea subovata* (*O. Marshii*, Marcou) and *Gryphæa Pitcheri*, var. *Tucumcarii*, together with the close lithological resemblance of the beds, show, in a very satisfactory manner its identity with the upper part, *i. e.* E, F and G of the Pyramid Mount Section, referred by Prof. Marcou to the Jurassic Period. I have before me specimens of *O. subovata* from Fort Washita, several localities in Grayson and McLennan counties, and from Mt. Bonnell, near Austin, some of them in a beautiful state of preservation, and have compared them most carefully with Marcou's figure of *Ostrea Marshii*, in the Geology of the U. S., without being able to detect any difference whatever of specific value. I have also compared my specimens of *O. subovata* with an authentic example of *O. Marshii* from Europe, and regard them as being specifically distinct, as much so as we usually find in closely allied species. But whether we regard them as identical or not, it is certain the beds whence Prof. Marcou obtained the so-called *O. Marshii* and *G. Tucumcarii* hold a position more than two hundred feet above strata that contain well marked Cretaceous types.

Blue Marl.—This member was examined in Grayson County by Dr. G. G. Shumard, who describes it as an indurated arenaceous marl, of a schistose structure, with small nodules of iron pyrites and irregular masses of lignite disseminated through it. It has not been recognized south of Grayson County.

The fossils are *Inoceramus problematicus*, *Ostrea*, and *Plicatula*, of undetermined species. It also abounds in fish remains, the scales and teeth of which are sometimes elegantly preserved.

This subdivision should perhaps be grouped with the preceding. It corresponds with No. 2 of the Nebraska Section.

CAPROTINA LIMESTONE.—The *Caprotina Limestone*, which follows in descending order, forms the base of the Upper Cretaceous, and is composed of light gray and yellowish gray earthy limestone, with intercalated bands of yellow marl, and sometimes flint. It is exposed at the base of the hills near Comanche Peak, and is seen underlying the Washita Limestone, near the Colorado, at the foot of Mt. Bonnell.

Fossils.—The lower portion abounds in *Caprotina Texana*, and the upper portion contains *Orbitolina Texana*, *Panopæa Newberryi*, *Cardium Brazoense*, *Arca Proutana*, *Cytherea*, *Cyprina*, *Natica acutispira*, *Phasianella perovata*, and *Cerithium*, and *Nerinea*, of undetermined species.

II. LOWER CRETACEOUS.

For a knowledge of this division of our Cretaceous system, I am indebted to Dr. G. G. Shumard, who has had excellent opportunities for examining it. He describes it as being composed of sandstones, and gypseous and marly clays; the latter containing numerous septaria filled with fossils. It is separable into two groups; namely, *Arenaceous* and *Marly Clay*, or *Red River Group*.

ARENACEOUS GROUP.—This member consists of light yellow and blue sandstone, and beds of sandy clay with crystals of selenite and some lignite. Its characters may be understood from the following section taken by Dr. G. G. Shumard, on Post-Oak Creek, in Grayson County.

No	1.	Soft, fine-grained, yellow sandstone,······ ············	10 feet.
"	2.	Hard, fine.grained, blue sandstone, becoming yellow upon exposure, and sometimes passing into gritstone and fine conglomerate······ ······ ···········	5 "
"	3.	Yellow sandstone, same as No. 1······ ············	10 "
"	4.	Indurated, blue, slaty clay, with crystals of selenite····	20 "
"	5.	Thinly laminated layers, same as No. 2······ ·····	8 "

Fossils.—The upper part is characterized by *Ostrea bellarugosa*, *Ostrea congesta*, *Lucina*, *Plicatula*, a small species of *Cyprina* (?), fossil wood, and occasionally obscure impressions of plants. The *Ostrea* occurs in distinct bands, and is extremely abundant. The lower beds have yielded an undescribed species of *Lingula*, and abound in fish remains, which Dr. Leidy refers to the following species: *Ptychodus mammilaris*, *Lamna compressa*, *L. Texana*, *Galeocerdo pristodontus*, and *Carcharodon*.

The strata of this group I regard as being strictly equivalent to divisions B, C and D, of the Pyramid Mount Section of Prof. Marcou, referred by him to the Jurassic Period. The stratigraphical position is the same, and the lithological characters of the beds are strikingly similar. That they can not be older than the Cretaceous is satisfactorily shown by the fossils above enumerated.

With regard to the Nebraska equivalent of our Arenaceous Group, I think there can scarcely be a doubt that it represents No. 1 (perhaps the upper part) of the section of Messrs. Hall, Meek and Hayden.

These authors have already pointed out the parallelism of A, B, C and D, of the Pyramid Mt. Section, with No. 1, of their Nebraska Section.

We have not yet succeeded in finding in the Texas sandstones and subordinate marls impressions of dicotyledonous leaves, which Meek and Hayden have found so characteristic of the sandstones occupying the base of the Nebraska Cretaceous, and which Dr. Newberry has discovered in such abundance and perfection in the equivalent beds of the western slope of the Rocky Mountains;* but it is almost certain they will be found in this position in Texas.

Marly Clay or Red River Group.—This member immediately underlies the fish bed of the Arenaceous Group, and is described by Dr. G. G. Shumard as "a blue marly clay, occasionally variegated with red and brown, and with thin bands of sandstone interstratified. The clay contains crystals of selenite, flattened nodules of compact brown and blue limestone, and septariæ of compact blue limestone, reticulated with brown, yellow and purple spar. The nodules occur in the upper and the septariæ towards the base of the formation. The best exposures of the group are in Grayson, on Post-Oak, Choctaw, and Big Mineral Creeks, where sections of from fifty to sixty feet have been measured. It occurs also on Red River, Fannin and Lamar counties. The estimated thickness of the group in this part of the State is about one hundred and fifty feet; but we have not seen the base of the formation."

Fossils are extremely abundant in the septariæ and nodules, and so far as I have been able to learn they belong to hitherto undescribed species. From the collections of Dr. G. G. Shumard, I have been able to characterize the following: *Ammonites Swallovii*, *A. inæquiplicatus*, *A. Meekianus*, *A. Graysonensis*, *Ancyloceras annulatus*, *Scaphites vermiculus*, *Baculites gracilis*, *Cytherea Lamarensis*, *Tapes Hilgardi*, *Gervilia gregaria*, *Nucula Haydeni*, *Panopæa subparallela*, *Corbula Graysonensis*, *C. Tuomeyi*, *Inoceramus capulus*, and *Inoceramus*, n. sp. Fossil wood is also quite common at several of the localities visited.

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* See Dr. Newberry's highly interesting paper on the Ancient Vegetation of N. A., in the March number of Silliman's Journal.

Hitherto no organic remains, except fossil wood, had been found in the Marly Clay Group of Texas and New Mexico; and hence the uncertainty regarding the true age of the formation until the fortunate discovery of the abovementioned fossils, which show conclusively that it belongs to the Cretaceous Period. That these beds, under notice, are equivalent to the blue clay forming the lower part of the Pyramid Mt. Section, and which Prof. Marcou refers to the Trias, will, I think, scarcely admit of a doubt; and it appears to me somewhat probable that a closer examination of the region around Pyramid Mount than Prof. Marcou was able to make, would result in the discovery there of the same fossils that Dr. G. G. Shumard has found in Grayson County.

Descriptions of New Cretaceous Fossils *from Texas.**

By B. F. Shumard, M.D., *State Geologist.*

CEPHALAPODA.

GENUS NAUTILUS.

N. Texanus, n. sp.

Shell large, last volution expanding rapidly towards the aperture; sides gently convex; dorsum strongly rounded; siphuncle situated between the center and ventral margin; septæ flexuous, aperture semielliptical, height greater than the width, broadest posteriorly, and deeply excavated by the preceding volution; surface ornamented with numerous flexuous, flattened convex ribs, which arise from the umbilicus, are arched forwards on the sides, and form a broad and rather deep sinus on the dorsum.

Although fragments of this species have been found at a number of localities in Texas, we have not been so fortunate as to procure an entire specimen.

The *N. Texanus* resembles somewhat closely the *N. pseudo-elegans* of D'Orbigny, from which it may be distinguished by the form of the aperture, which is more elongated in our shell.

Locality.—Occurs in the Washita Limestone, associated with *Epiaster elegans* and *Ostrea subovata*, near Austin and Bluffs of Red River, in Grayson County.

Collected by B. F. and G. G. Shumard and W. P. Riddell.

* The interesting series of fossils described in this paper have been collected during the progress of the Geological and Agricultural Survey of Texas, and are preserved in the State Cabinet at Austin. It is intended to publish more extended descriptions, with figures illustrating the species, in our Geological Report.

GENUS AMMONITES.

A. INÆQUIPLICATUS, n. sp.

Shell large, gibbous, sides rounded; dorsum flat or very slightly convex; volutions four, partially embracing; umbilicus deep, less than the width of the last volution, exhibiting about one half of each of the inner coils; aperture transverse, subreniform; surface of body volution ornamented with from 25–28 very prominent, unequal, rounded costæ, some arising rather abruptly from the margin of the umbilicus, and others a short distance exterior to the latter—all of them being continued over the dorsum, at the margins of which they become obtusely angulated. Each rib bears two moderately distinct nodes, which are situated at their dorsal angles. In mature shells, the ribs of the anterior portion of the last volution are considerably narrower than the spaces between, while posteriorly the ribs and spaces are about equal; aperture transverse, reniform.

Chambers divided into two lobes on either side; dorsal lobe as wide and longer than the superior lateral, composed of three principal, narrow branches on each side, and one or more short points in the intervals, the terminal branches bearing six or seven short points, the middle lateral ones four or five, and those at the base either simple or with one or two points; dorsal saddle double the width of the dorsal lobe, divided into two unequal lobes by a small auxiliary lobe, which is marked with several small points; superior lateral lobe oblique, its extremity furnished with four slender branches, each bearing several small points.

Diameter 5 inches, width of last volution 2 inches, thickness $2\frac{3}{10}$ inches.

I have seen but one specimen of this strongly marked species. It was found near the base of our Cretaceous strata, in septariæ, embedded in blue marly clay at Garnet's Bluff, on Red River, Fannin county, associated with *Ammonites Swallovianus* and *A. Meekianus*. Collected by Dr. G. G. Shumard.

A. SWALLOVII, n. sp.

Shell compressed, discoid; sides gently convex; dorsum flattened, transversely ribbed, nodose-bicarinate; volutions four, partially embracing; umbilicus deep, exhibiting about one-third of each of the inner volutions, and about as wide as one half of the width of the last volution; aperture subovate, longer than wide, truncated and narrowest at the dorsal edge; surface marked near the umbilicus with a series of transversely elongated nodes or tubercles, from each of which proceeds a pair of moderately prominent, rounded flexuous ribs, while between the pairs there is often a single rib. All of the ribs are continued over the dorsum, and each bears a pair of lengthened tubercles, one situated at the dorsal margin and the other on the side a short distance within; the former being most prominent. In young shells, the nodes around the umbilicus are usually wanting.

Chambers symmetrical, dorsal lobe nearly as large as the superior lateral lobe, bearing on either side three short points, the terminal ones being largest and sharply digitate; dorsal saddle almost double the width of the superior lateral lobe, and divided into two unequal branches by a short subconical auxiliary lobe; the dorsal branch having three small notches, while the inner one is rounded and has usually only a single small notch at its internal border; superior lateral lobe somewhat longer than wide, broadest at base, its extremity bearing five very small branches, the inner one being simple, the others bifid or trifid; inferior lateral lobe very small, scarcely one-fourth as large as the superior, serrated at extremity; auxiliary lobes diminishing in size towards the ventral margin.

The lobes of the chambers in young individuals of this species are almost as simple as in *Ceratites*, to which genus, after a cursory examination I had at first referred them; but a further study of a number of specimens, in various stages of growth, has convinced me that they belong more properly to *Ammonites*.

The diameter of the largest specimen (imperfect) in the collection is six inches. A young specimen gives for diameter, $3\frac{1}{2}$ inches; width of last volution $1\frac{1}{12}$ inches; thickness, $1\frac{4}{12}$ inches.

Form. and Locality.—This is the most beautiful species of *Ammonite* we have found in the Cretaceous strata of Texas, and quite characteristic of the marls and calcareous sandstones forming the base of the formation.

Occurs in Grayson County, four and a half miles north of Sherman, and Bluffs of Red River, in Fannin and Lamar Counties.

A. MEEKIANUS, n. sp.

Shell large, discoidal, compressed (number of volutions unknown); transverse section of last volution subquadrate or subcircular; sides flattened convex; dorsum, broad, flat, or very gently convex, bearing a narrow sharply defined central carina; surface marked with somewhat distant, transverse, subangular ribs which arise near the umbilical margin, where they are slightly swelled or subnodose, and terminate at the dorsal margin, each in a remarkably prominent node, subtriangular at base and with the extremity directed laterally.

Chambers divided into three lobes on either side, diminishing rapidly in size from dorsal to ventral margin; dorsal lobe longer and wider than the superior lateral, bearing six points on either side, the terminal ones being the larger and trifurcate; dorsal saddle double the width, but shorter than the dorsal lobe, divided into two unequal parts by a slender digitate auxiliary lobe; superior lateral lobe shorter and narrower than the dorsal lobe, ornamented with five small branches on each side, the terminal ones trifid, and the others simple or bifid; inferior lateral lobe narrow, much smaller than the superior, having eight branches, the terminal ones bearing two or three points.

In young individuals, the dorsum is more flattened than in mature shells, the sides slightly converge towards the ventral margin, and occasionally we find small nodes in the intervals between the larger ones of the dorsal margin.

The *A. Meekianus* is founded merely upon fragments of the exterior volution, which, however, show the form of the lobes of the septæ very perfectly, so that there is no danger of confounding it with any other American species.

Width and thickness of last volution, two inches.

Form. and Locality.—Occurs with the preceding species near Post-Oak Creek, Grayson County. Dedicated to the able Palæontologist and Geologist, F. B. Meek, Esq., of Washington, D. C.

A. Graysonensis, n. sp.

Shell compressed, discoidal; whorls, four or five, very slightly embracing; last one very gradually enlarging; transverse section narrow, subcordate; umbilicus shallow, a little wider than the last whorl, exhibiting all of the inner volutions; surface marked on the dorsum with a prominent narrow carina, with a waved-edge; and on the sides with from 35 to 38 sharp, distinct flexuous folds, some of which originate within, and others on the margin of the umbilicus—all of them extending to the dorsal carina, being abruptly bent forward, and most prominent on the dorso-lateral margin.

I have before me a number of examples of this species, but none of them show the form of the chambers.

Diameter, 1.43 inches; width of last volution at aperture, 0.54 inches; thickness, 0.34 inches.

This shell is very nearly related to *A. percarinatus*, of Hall and Meek (*Mem. Amer. Acad. Arts & Sci.*, Vol. V., p. 396, Pl. iv., Fig. 2 a–c.), from which it may be distinguished by its waved-edge and less prominent dorsal carina. The Nebraska shell has also a greater number of ribs.

Form. and Locality.—Occurs in septariæ, embedded in the Lower Cretaceous Marls in Fannin County, near Lowell's

Bluff, and in Grayson County, four miles north of Sherman. At the latter locality it is associated with *Scaphites vermiculus.*

A. BRAZOENSIS, n. sp.

Shell very large, discoidal, moderately compressed; whorls five or six; last whorl strongly rounded on the dorsum, sides gently convex and bearing ten or eleven broad, slightly prominent, convex folds, which are most elevated in the middle and become nearly obsolete before reaching the dorsum and umbilicus; umbilicus deep, exhibiting rather more than one-third of each of the inner whorls, and having a diameter less than the width of the last whorl; aperture semielliptical, longer than wide.

Chambers divided into five lobes on either side, diminishing in size from dorsal to ventral margin; dorsal lobe wider, but not quite as long as the superior lateral, divided into three or four(?) digitate branches on either side, the terminal ones bifid and each division furnished with several points; dorsal saddle larger than the superior lateral lobe, and finely digitate; superior lateral lobe with three terminal branches, the outer ones bifid and nearly equal in size, the middle one trifid and largest; inferior lateral lobe much smaller than the superior, and about half the size of the superior lateral saddle.

The description of the septæ here given has been drawn from an inner volution, having a width of only about two inches. In full grown shells the lobes of the body volution are more complicated. This shell presents also another difference with age which should be noticed. In young examples the greatest thickness of the last volution is near the umbilical margin, the transverse section being cordate, but in adult age the thickness is quite as great at the dorsal as at the ventral margin, and the section then is semielliptical.

The *A. Brazoensis* attains a greater size than any species we have seen from the Cretaceous strata of Texas. The largest specimen in the State collection measures as follows:—Greatest diameter, 1 foot 9 inches; thickness, 6½ inches; width of last volution at aperture, 8 inches.

Form. and Locality.—Occurs in the Washita Limestone, near the base of the Upper Cretaceous strata, at Shovel Creek, near Austin, and very abundantly in Grayson and Fannin Counties. I have also specimens before me from McLennan County, and from the vicinity of Ft. Washita. Collected by B. F. and G. G. Shumard and W. P. Riddell.

GENUS SCAPHITES.

S. VERMICULUS, n. sp.

Shell small, ovate, length not quite one-third greater than the height; sides gently convex, dorsum strongly rounded ventral side flattened, obtusely subangulated at junction with sides; body whorl slightly sinuate, very gradually enlarging, and produced horizontally for a distance equal to the diameter of the regularly coiled part, then curved backwards so as to bring the aperture to within a short distance of the middle of the long diameter of the shell; volutions of the spire partially embracing, leaving a deep umbilicus in which three or four coils are visible; surface marked with a few obscure, transverse folds, and fine striæ of increase. The folds are usually perceptible only on the septate portion of the shell.

We have a number of specimens of this pretty little species, but none of them show the form of the septæ with sufficient distinctness to permit us to trace out their precise characters.

Length, 0.64; greatest height, 0.42; thickness, 0.18.

Resembles somewhat *Scaphites æqualis* of Sowerby, but is a smaller and porportionally a more slender species, and the transverse folds of our shell are neither so numerous nor prominent.

Near the base of the Lower Cretaceous, occurring in Septaria of the marly clay in Grayson County, about four miles north of Sherman.

Collected by Dr. G. G. Shumard.

GENUS ANCYLOCERAS.

A. ANNULATUS, n. sp.

We have merely fragments of this small species, consisting of about two-thirds of the outer coil of the spire and parts of the non-septate portion. The former is very slender, and forms a broad curve on the same plane; sides and dorsum rounded, the latter being somewhat the less convex; transverse section nearly circular; surface marked with numerous prominent, oblique, simple rings, which are strongest on the dorsal half of the volution. Each annulation is provided with two small, rather prominent tubercles, one of which is situated on each side of the dorsum.

It is not possible from any of the specimens under examination to determine the form of the septæ.

The transverse diameter of the largest fragment of the outer volution in the collection is a little more than the third of an inch.

Shawnee Creek, Grayson County, in nodules of clay iron stone, embedded in the indurated marly clay near the base of the Lower Cretaceous strata.

Collected by Dr. G. G. Shumard.

GENUS BACULITES.

B. gracilis, n. sp.

Shell very slender, gradually tapering to apex; transverse section varying from broad ovate to subcircular; surface in some specimens nearly smooth, but usually marked with moderately prominent, rounded costæ, which on the dorsum are distinct and arched towards the aperture, and on the sides curve obliquely backwards and downwards to the ventral margin, before reaching which they become nearly obsolete. Some of the specimens exhibit very fine flexuous striæ of growth.

Chambers divided into four lobes, two lateral, one dorsal, and one ventral; dorsal lobe rather wider, but scarcely as long as the superior lateral, divided into two branches on either side, the lateral branches simple, and the terminal ones each marked with four small digitations; dorsal saddle as large or a little larger than the dorsal lobe, divided by a slender auxiliary lobe into two unequal branches, which are trifid at extremities; superior lateral lobe longer and narrower than the dorsal, but in other respects nearly similar.

This description of the septæ here given has been derived from a fragment having a diameter of two lines, this being the only specimen in the State collection showing the form of the lobes distinctly.

The diameter of the largest fragment found is 0.50 of an inch, but the diameter of most of the specimens does not exceed 0.25 of an inch. This shell may be compared with *B. Neocomiensis* of D'Orbigny, from which it differs in the form of the septæ, the lobes being porportionally wider and the saddles narrower in our species.

Locality.—In nodules of argillaceous iron stone, with the preceding species, Shawnee Creek, Grayson County. Collected by G. G. Shumard.

GASTEROPODA.

GENUS CERITHIUM.

C. Bosquense, n. sp.

Shell large, elongate-conic, turreted; spiral angle 22°–25°; volution (number unknown) flattened; last volution (cast of) shorter than the width, rounded beneath; aperture ovate, oblique, contracted above and below, and widest below the middle; surface of volutions marked with 11–12 broad, rounded longitudinal ribs or folds, which are moderately distinct above, and become obsolete before reaching the inferior edge of the volution.

There is but one specimen of this shell in the collection, consisting of the body and three of the succeeding volutions, on the latter of which parts of the shell remain attached.

Locality.—Near Bosque Creek, Bosque County, in the upper division of the Upper Cretaceous Limestone, occurring with *Exogyra Texana* and *Lima Wacoensis.*

GENUS PHASIANELLA.

P. PEROVATA, n. sp.

Shell ovoid, height not quite double the width; volutions about seven, gently convex; last one moderately gibbous, a little longer than the spire; spire somewhat rapidly enlarging from the apex, spiral angle 50°–55° gently convex; suture distinct, linear, not very deeply impressed; aperture oblique, acute above, rounded below; surface smooth or marked with fine lines of growth.

The measurements of the most perfect specimen (half grown) in the collection are, height, 1.20 inches; width, 0.70; height of last volution, 0.68.

Localities.—Inferior part of Upper Cretaceous (Caprotina Limestone), Comanche Peak, and in Parker County, near Brazos River.

GENUS AVELLANA.

A. TEXANA, n. sp.

Shell small, globose; spire occupying about one-fifth of the total length, conxex; volutions about three and a half, rounded, last one gibbous; aperture oblique, subovate, rounded below and contracted above; lip thickened (expanded?); surface with rounded revolving lines, of which there are from 22–25 on the last volution.

We have two specimens of this species, in both of which the columella is so enveloped with matrix that we are not able to ascertain whether it is plaited or not. The species, however, has all the external characters of *Avellana.*

Length, 0.36; width, about 0.26; height of last coil, 0.29.

Resembles *Actæon concinna* of Hall and Meek, but is a larger shell and has fewer revolving striæ.

Locality.—Found in the upper part of the Cretaceous Limestone, near Bosque Creek, in Bosque County, in connection with *Exogyra Texana* and *Ammonites pedernalis.*

GENUS NATICA.

N. ACUTISPIRA, n. sp.

Shell obliquely ovate, length greater than the width; spire not much elevated, contracted above and acutely pointed at apex; spiral angle 84°; volutions six or seven, neatly rounded, last one very ventricose, forming rather more than two-thirds the total length of the shell; aperture ovate, rounded below, narrow above; columellar lip thickened, deflected and partially covering the umbilicus; suture distinctly impressed; surface smooth, or marked with fine lines of growth.

Length, 0.66; width, 0.53; height of body volution, 0.43.

Locality.—Very abundant near the base of the Upper Cretaceous series, in the Caprotina Limestone, Parker County, near Brazos River. B. F. Shumard and W. P. Riddell, collectors.

GENUS NERITOPSIS.

N. BIANGULATUS, n. sp.

Shell depressed, width greater than the height; spire short, obtuse at apex (in cast), forming about one-fifth of the total height of the shell; volutions 3–3½ angulated above, upper surface narrow, flat, declining very gradually from angle of periphery to suture; last volution very large, transverse diameter greater than the height, periphery convex, angulated below, but less sharply than above; surface of cast exhibiting obscure, coarse striæ, which are preserved only on the side of the body volution, where they pass obliquely downwards and backwards from the superior to the inferior angle.

Height, 1.10 in.; width, 1.42.

The few examples of this species we have seen are casts, and occur with *Inoceramus problematicus* and *Hamites Fremonti* near the base of the Upper Cretaceous Limestone.

Locality.—Alexander's Bend, Grayson County.

ACEPHALA.

GENUS VENUS.

V. SUBLAMELLOSUS, n. sp.

Shell small, compressed, ovate, a little longer than wide; extremities rounded, the posterior broader than the anterior; base semiovate; beaks nearly central, moderately elevated, closely incurved, approximate; lunule rather large lanceolate, not deeply impressed, but with margins distinctly defined; ligament area narrow lanceolate, pallial sinus rather large, extremity rather bluntly rounded; surface marked with prominent, sharp, sublamellose, concentric striæ.

Length, 0.57; width, 0.49; thickness, 0.26. This is a neat little species, and quite distinct from any hitherto described species from American strata.

The collection contains but two specimens, neither of which show the hinge, and I am therefore in some doubt as to whether it properly belongs with the above genus or *Cytherea*.

Form. and Locality.—Grayson County, five miles north of Sherman, associated with *Scaphites vermiculus*, in Septaria of the Marly clay, near the base of the Lower Cretaceous. Collected by Dr. G. G. Shumard.

GENUS CARDIUM.

C. CHOCTAWENSE, n. sp.

Shell obliquely subovate, wider than long, gibbous, greatest convexity between the beaks and the middle of the shell; posterior slopes declining rapidly to the anal margin, concave superiorly and plane below, their outline distinctly cordiform; anal margin gently convex or sub-truncate, extremity strongly rounded; buccal and pallial margins forming a continuous curve from hinge to anal end; cardinal margin gently arched, short, scarcely equal to one half of the length of the shell; beaks situated nearest the anterior extremity, elevated, incurved nearly in contact; lunule excavated, margin not distinctly defined; surface ornamented with about 35 distinct, rounded radiating ribs, crossed by numerous well-defined, waved, concentric striæ, which impart to the ribs an elegantly crenulate appearance, intervals between the ribs not as wide as the ribs themselves.

Length, 0.64; width, 0.71; thickness, 0.51.

Locality.—Post-Oak Creek, Grayson County, associated with *Ostrea bellarugosa*.

This is a rare shell and quite distinct from any species known to me from the Cretaceous strata of the United States. Collected by Dr. G. G. Shumard.

C. COLORADOENSE, n. sp.

Cast of shell triangular; length and width about equal; special angle, 75°–80°; umbonial region gibbous superiorly, and sloping inferiorly to the pallial margin; buccal margin rounded below and excavated above; posterior margin sloping abruptly downwards to the posterior extremity, which is truncated; base regularly but not strongly rounded; beaks much elevated, antemedial; lunule rather wide elliptical, depressed; corselet large, depressed, cordiform. All of the specimens in the collection are casts; some of them, however, showing distinctly fine concentric striæ on the buccal and umbonial regions and radiating striæ on the exterior border of the corselet.

Length and width, 0.60 of an inch; thickness, 0.46.

This shell is quite characteristic of the superior part of our

Upper Cretaceous Limestone, occurring with *Exogyra Texana* and *Ammonites pedernalis*.

We have found it in Burnet, Travis, Bosque, Johnson and McLennan Counties, and Dr. G. G. Shumard found it holding the same geological position several hundred miles further westward. Collected by B. F. and G. G. Shumard and W. P. Riddell.

C. Brazoense, n. sp.

Shell cordate, subovate, very gibbous; length and width nearly equal; umbonial region strongly convex; buccal margin strongly rounding up from the base, which is gently convex; and margin slightly arched, and forming with the basal margin almost a right angle; anal region broad, subcordate, sloping rapidly from the sides to the posterior commissure of the valves; anterior cardinal edge oblique; an obscure elevation commencing before the beaks, and extending parallel with the cardinal edge to the anterior margin; beaks elevated, rounded, strongly incurved, situated a little posterior to the middle; surface of buccal and umbonial regions, marked with fine, pretty regular, concentric striæ, which are wider than the intervals that separate them, and on the anal region or corselet with from eighteen to twenty fine radiating striæ.

Length, 1.52; width, 1.58; thickness, about 1.38.

This shell resembles *C. multistriatum*, but is much more gibbous, has a greater number of striæ on the corselet, and the beak is posterior to the middle, while in the *C. multistriatum* it is anterior.

Localities.—Occurs near the base of the Upper Cretaceous Limestone (*Caprotina Limestone*), in Johnson County, at Comanche Peak, a few feet above the level of Brazos River, and near Patrick's Creek, Parker County.

GENUS CYTHEREA.

C. Lamarensis, n. sp.

Shell broad, ovate, longer than wide, scarcely gibbous; beaks moderately elevated, closely incurved, nearly in contact, situated in advance of the middle; umbo rounded; cardinal border arched behind and presenting a nearly straight declining edge before the beaks; anal extremity wider than the buccal, strongly rounded; buccal end narrowly rounded; base semioval; ligament impression very narrow lanceolate; lunule very slightly impressed, broad lanceolate, its margins defined by a delicately impressed line, which would scarcely be noticed upon a superficial examination; anterior muscular impression subovate, concave at upper internal edge; posterior impression subcircular, or subquadrate; sinus rather broad, triangular, scarcely reaching the middle of the shell. Surface ornamented with remarkably fine, concentric striæ of growth.

Dimensions of an average specimen, length, 0.97 of an inch; width, 0.74; thickness, 0.45.

This shell may be compared with *C. Owenana* of Meek and Hayden, (Proc. Acad. Nat. Sci., Philadelphia, Vol. —, p. —) with which it agrees in several respects, and it probably occupies a similar geological position. The differences seem to consist mainly in the absence of concentric wrinkles on the surface, the shorter pallial sinus, and smaller size, of the Texan shell.

Locality.—In Septaria of the marly clay at the base of the Lower Cretaceous Strata, Red River, Lamar County. Collected by Dr. G. G. Shumard.

GENUS TAPES.

T. Hilgardi, n. sp.

Shell ovate, transversely elongate, valves compressed, convex; extremities rounded, the anal end narrower than the buccal, and in adult specimens approaching to subtruncate; cardinal border long, curving gently from the beaks posteriorly; basal margin very gently convex; beaks situated about one-third the length of the shell from the anterior margin, rather short, nearly in contact; ligament area depressed, narrow lanceolate; pallial sinus linguæform extending above the middle of the height of the shell. The surface markings are not well preserved in any of the specimens before me. They show merely fine concentric lines of growth near the basal margin.

Length, 2 inches; width, 1.27; thickness, 0.66.

Locality.—Bluffs of Red River, Lamar and Fannin Counties, occurring in Septaria of the marly clay, near the base of the Lower Cretaceous.

Named in honor of Dr. E. W. Hilgard, State Geologist of Mississippi. Collected by Dr. G. G. Shumard.

GENUS ARCA.

A. Proutiana, n. sp.

Shell somewhat trapezoidal, very gibbous, a little wider than long; buccal and pallial margins rounded; and margin obliquely truncate; umbonial region very gibbous; angulated posteriorly; posterior slope declining rapidly to the margin, a sharp elevated carina or fold extending in a curve from the posterior side of the beak to near the middle of the anal margin; beaks elevated, rather narrow, incurved, situated nearly central; surface ornamented with numerous fine, concentric striæ, crossed by radiating lines, presenting a handsome crenulated appearance under the magnifier. The concentric striæ are waved as they cross the carinæ of the posterior slope, and in the most perfect specimen before me there are six or seven quite prominent radiating lines on the buccal end of the shell.

Length, 1.88 inches; height, 1.58; thickness, 1.40.

Form. and Loc.—Comanche Peak, and Parker County, near the Brazos river. Near base of Upper Cretaceous in the Caprotina Limestone.

Dedicated to my friend, Hiram A. Prout, M.D., President of the Academy of Science of St. Louis.

GENUS LUCINA.

L. SUBLENTICULARIS, n. sp.

Shell rather large, subcircular, compressed convex; length slightly greater than the width; anterior and pallial margins regularly rounded; anal margin gently convex, or obscurely truncate; posterior cardinal margin gently arched, and declining from the beaks posteriorly; ligament area narrow lanceolate, deeply excavated and with sharply carinate margins; beaks obtuse, small, very little elevated, directed anteriorly, antemedial, not in contact; surface marked with numerous, fine, concentric, unequal lines of growth.

Length, 1.87 inches; width, 1.74; thickness, 0.74.

Form. and Loc.—Bluffs of Red River, in Lamar and Fannin Counties, from Septaria embedded in the indurated marl, near the base of the Lower Cretaceous Group, associated with *Ammonites Swallovii*, *Inoceramus capulus*, and *Gervilia gregaria*. Collected by G. G. Shumard.

GENUS NUCULA.

N. HAYDENI, n. sp.

Shell subtriangular, ovate, somewhat gibbous in the umbonial region; width equal to three-fourths of the length; beaks moderately elevated, located in advance of the middle and nearly in contact; buccal region rather short, narrowly rounded at extremity, and excavated above; anal region long, cuneate; base semioval; cardinal margin straight, sloping gradually to posterior end; corselet depressed, rather broad lanceolate, marked with oblique, transverse ribs; surface ornamented with fine waved lines of growth, crossed with numerous, fine, radiating striæ, with finer lines in the intervals.

Length, 0.74 inches; width, 0.54; thickness, 0.37; apicial angle 109°.

Of this fine species we have found but one specimen, which is somewhat worn, although the surface markings are tolerably well preserved.

Locality.—Red River, Fannin County. In Septaria of Lower Cretaceous Group.

Dedicated to Dr. F. V. Hayden, the well-known scientific explorer of the Upper Missouri Country. Collected by Dr. G. G. Shumard.

N. SERRATA, n. sp.

Shell ovate, very gibbous, width and thickness about equal; beaks nearest the anterior margin moderately elevated, obtuse; buccal end short, obliquely truncated, forming with the basal margin nearly a right angle; anal side rather strongly rounded; base convex, finely serrated; corselet elliptical; lunule round, ovate, not deeply excavated; hinge bearing long closely-set lammellæform teeth; surface elegantly marked with extremely fine, crowded, waved lines of growth and some obscure concentric folds crossed with fine radiating flattened striæ.

Length, 0.94; thickness, 0.60.

There is but one specimen of this shell in the State Collection, and that is somewhat worn, so that we are not able to give a full description of the species.

Form. and Locality.—In septaria of the marly clay, near the base of the Lower Cretaceous group. Bluffs of Red River, Lamar County. Collected by Dr. G. G. Shumard.

GENUS CORBULA.

C. GRAYSONENSIS, n. sp.

Shell compressed, broad triangular; right valve the larger, more gibbous than the left, which it overlaps at the margins; anterior side shorter than the posterior, strongly rounded; posterior margin nearly straight, sloping from beak to anal extremity, which is angulated; pallial margin gently arched; beaks small, very slightly elevated, approximate, situated nearest the anterior margin; surface marked with fine, distinct concentric striæ of growth.

Length, 0.54; width, 0.40; thickness, 0.24.

This species is more compressed than any species known to me from American Cretaceous strata.

Formation and Locality.—In hard, fine-grained sandstone (*Lower Cretaceous*) associated with *Ostrea bellarugosa* and *O. congesta.* Post-oak Creek, near Sherman, Grayson County. Collected by Dr. G. G. Shumard.

C. Tuomeyi, n. sp.

Shell small, inequivalve, ovate, subtrigonal; length greater than the height; valves convex, the right more gibbous than the left; anterior side strongly and regularly rounded; and side suddenly contracted and prolonged posteriorly, the extremity abruptly truncated; beaks moderately elevated, situated in advance of the middle of the shell; surface ornamented with fine, regular, distinct, concentric striæ, which are continued upon the prolonged portion, being parallel with its inferior and posterior margins.

Length, 0.50; width, 0.33; thickness of right valve, 0.20.

This species may be identical with *C. candata* of Tuomey (Proc. Acad. Nat. Sciences, Phila., Vol. 7, p. 108,) but the description of Prof. Tuomey is too short to permit us to make a sufficiently minute comparison. If the two shells should prove to be identical, the name above given must still be adopted, since the specific name *candata* was applied by Nilson to a European shell of this genus, some years before the description of Tuomey was published.

Form. and Locality.—Occurs in the Septaria of the Lower Cretaceous Group, in Grayson County, four and a half miles north of Sherman. Collected by Dr. G. G. Shumard.

GENUS PACHYMYA.

P. Austinensis, n. sp.

Shell very large, length more than double the width, and less than double the thickness; greatest width near the center, where the shell is very gibbous; subangulated diagonally from the posterior side of the beak to the anal extremity and sloping to the margins; posterior slope broad; sides constricted anteriorly by a broad, shallow depression, which commences some distance below the beaks and extends obliquely downwards and backwards to the base; superior and inferior margins subparallel; buccal end very short, narrowly rounded; anal end obliquely truncate, gaping, angulated at extremity; pallial margin concave in the middle, rounded before, and very gently convex posteriorly; beaks nearly terminal, flattened, incurved, approximate; surface marked with irregular, concentric lines of growth.

Length, 6.30 inches; width, 2.30; thickness, 3.64.

This shell is very nearly related to, if not identical with, *P. gigas* of Sowerby (Min. Conch., Vol. 6, p. 1, pl. 504–505.) The only essential points of difference that I can perceive are, that in the foreign shell the beaks are situated nearer the anterior extremity, and the sides do not exhibit the oblique anterior depression, which appears to be a constant feature in the Texan fossil.

For the favor of describing this interesting shell, I am indebted to G. F. Wright, Esq., who found it in the Washita Limestone, on Shoal Creek, near Austin, associated with *Terebratula Wacoensis*, *Turrilites Brazoensis*, and *Ostrea subovata*. It is here confined to a narrow band of a few inches in thickness.

GENUS PANOPÆA.

P. Newberryi, n. sp.

Shell oblong-subovate, length from one-fourth to one-third greater than the height; anterior end broader than the posterior; umbonial region gibbous; buccal margin rather strongly rounded; anal region narrowing from the beaks posteriorly; extremity broadly rounded, subtruncate and gaping; pallial border gently arched; beaks rather small, not much elevated, strongly incurved, nearly approximate and located considerably in advance of the middle; surface marked with fine irregular lines of growth and some obscure concentric wrinkles, which are most apparent on the anal region.

Length, $2\frac{8}{10}$ inches; width, $1\frac{8}{10}$; thickness, $1\frac{3}{10}$.

In adult specimens the anal end is proportionally much narrower than in the young. Resembles very closely *P. recta* of D'Orbigny (*Pal. Franc.* tom. 3, p. 384, pl. 356, Fig. 1–2), but differs in being perfectly closed at the buccal end, while in the foreign species it is gaping.

Locality.—Very characteristic of the Caprotina Limestone, near the base of our Upper Cretaceous Strata, in Parker County, and Comanche Peak, Johnson County. Collected by B. F. Shumard and W. P. Riddell.

P. subparallela, n. sp.

Shell subovate; length double the width; extremities of nearly equal width; buccal side short, strongly and regularly rounded; anal end widely gaping, obliquely truncate; pallial margin gently convex in the middle and abruptly rounded at the extremities; cardinal border subparallel with the base; beaks approximate, not much elevated, situated considerably in advance of the middle; surface marked with somewhat irregular, narrow, concentric folds, which are most prominent on the anterior and upper portion of the shell.

Length, 3.11 inches; width, 1.58; thickness, 0.94.

The only example of this shell in the collection is somewhat crushed in the region of the beaks, and not altogether perfect at the anal extremity. It may therefore become necessary to somewhat modify our description, when better preserved specimens are found. The *P. subparallela* is closely allied to *P. occidentalis*, a Nebraska species described by Messrs. Meek and Hayden. The differences exist in the form of the extremities, which are of unequal width in the Nebraska shell, while in ours they are about equal.

Form. and Locality.—In Septaria of the marly clay, near base of the Lower Cretacious Group. Red River, Fannin County. Collected by Dr. G. G. Shumard.

GENUS INOCERAMUS.

I. CAPULUS, n. sp.

Shell subequivalve, elongate-ovate, section subcordate, antero-posterior diameter much shorter than from beak to base; umbonial region very gibbous; anterior slope falling abruptly to the margins, flattened above and more or less rounded below, margin sinuous; straight or slightly posterior slope convex; anal margin rounded, forming with the cardinal an obtuse angle; base strongly arched; beaks terminal or nearly so, much elevated, curved forward, pointed; surface neatly ornamented with small, unequal, distinct concentric folds. In well preserved specimens the umbo is marked with a few obscure, radiating ribs. The shell structure is made up of thin concentric laminæ.

Length, 1 inch; height, 1.83; thickness, about 1.50.

There is a fragment of this shell before me which shows that in mature age the dimensions are nearly double those here given.

The *I. capulus* corresponds in many respects with *I. umbonatus*, a species of the Cretaceous Strata of Nebraska, and described by Messrs. Meek and Hayden (Proc. Acad. Sci., Phila., Vol. 8, p. 50), but its height is proportionally greater, and the opening of either valve is distinctly ovate and not subcircular as in the Nebraska fossil. The description, however, of Messrs. Meek and Hayden comes so nearly to our fossil, that it is not without some hesitation that a new name is proposed.

Form. and Locality. — Occurs in Concretionary Green Sandstone of the Lower Cretaceous period, associated with *Ammonites Swallovii* and *Tapes Hilgardi*. Bluffs of Red River, Lamar County. Collected by Dr. G. G. Shumard.

GENUS GERVILIA.

G. GREGARIA, n. sp.

Shell inequivalve, oblique, subovate, approaching subquadrate, moderately gibbous; wider than long; right valve more gibbous than the left, its anterior third strongly rounded; umbonial region convex for a short distance from the beak and thence flattened to the anal extremity, which is subtruncate on the pallial side and furnished on the cardinal side with a long, narrow, triangular expansion; anterior margin forming a long, sweeping curve from beak to base; cardinal line straight, forming with the posterior margin an obtuse angle; beaks nearly terminal, scarcely passing the cardinal line; ligament facet rather narrow, marked with three or four pits which are rather shallow, and about equal to the spaces between; surface with numerous fine, concentric lines of growth, which, towards the base, assume a subimbricated character.

Length of cardinal margin, 1.20 inches; from point of beak to anal extremity, 1.86 inches; thickness of right valve, 0.32.

Form. and Locality.—Bluffs of Red River, Lamar County, in Septaria embedded in the blue indurated marl near the base of the Lower Cretaceous Series. Collected by Dr. G. G. Shumard.

GENUS JANIRA.

J. Wrightii, n sp.

Shell ovate, subtrigonal, longest diameter from beak to base; superior valve flat or slightly concave, marked with three strong, rounded, plications, which are prolonged at the base into prominent angles; inferior valve strongly convex; anterior and posterior slopes abrupt, margins straight and diverging from the beak at an angle of about 40°; surface ornamented with four very prominent, simple radiating ribs or folds on the body of the shell, and one much less developed just within the margin on either side. Both valves are also elegantly marked with crowded, strongly waved concentric filiform striæ; beaks elongated, slender, incurved; wings unknown.

Length, 6 lines; width, 8 lines.

This shell differs from *Janira occidentalis* and *J. Texanus* in having a fewer number of ribs, there being no small ones in the intervals between the larger as in those species.

Form. and Locality.—Two specimens of this shell were found by G. F. Wright, Esq., in the Washita Limestone (near base of Upper Cretaceous) on Shoal Creek, near Austin. It was there found associated with *Janira Texana*, and *Terebratula Wacoensis*.

The species is dedicated to Mr. G. F. Wright, to whose politeness I am indebted for the privilege of describing it.

GENUS OSTREA.

O. QUADRIPLICATA, n. sp.

Shell small, usually arcuate, rarely elongate-subovate; longer than wide; anterior and basal margins produced into four angles, which are sometimes quite salient; and margin more or less deeply excavated. Superior valve flat or a little convex at the umbo; beak obtusely rounded or subtruncate at tip; surface elegantly ornamented with imbricating lines of growth, which are crossed by numerous radiating stria; margins finely crenulate; interior gently concave; muscular impression subovate, situated near the anal border; ligament facet short, subtrigonal, and finely striated transversely. Inferior valve more or less gibbous, posterior slope falling abruptly to the margin; beak moderately sharp, rounded at tip and directed upwards and backwards; surface with imbricating concentric, crossed by rather coarse, radiating, bifurcating striæ, and usually four prominent folds, which commence on the umbo, at some distance from the beak, and terminate at the angles of the border. In nearly all full-grown specimens that I have seen, the radiating striæ occupy merely the rostral half of the shell. The dimensions of an average specimen are—

Length, 1.30 inches; width, 0.80; thickness, 0.40.

This is an exceedingly handsome shell, and not liable to be mistaken for any other species. It occurs very abundantly associated with *Cidaris hemigranosus.*

O. BELLAPLICATA, n. sp.

Shell of medium size, ovate or subcircular, anal and pallial borders rounded; buccal border subtruncate, valves unequal. Superior valve usually flat, but sometimes concave or even gently convex; hinge margin oblique, nearly straight; beak obtusely angular, angle from 105°—115°. Inferior valve convex, most prominent along the middle, and sometimes obtusely subangulated; beak acute, prolonged, situated nearest the buccal side, and slightly curved towards the opposite side; muscular impression large, moderately excavated, elongate-ovate, upper edge concave. Surface of valves marked with prominent concentric, waved, imbricating laminæ of growth and form, and from ten to fourteen elevated, obtusely angulated costæ, which originate near the beaks, and radiate to the margins.

In many of the specimens before me all of the ribs are simple, but in others some of them are bifurcated. In a few individuals they are sharply angulated at their extremities. The concentric laminæ are generally more distinct and more strongly marked on the superior than the inferior valve. The dimensions of an average specimen, are—

Length, $1\frac{9}{16}$ inches; width, from beak to base, $2\frac{3}{16}$ inches; thickness, $\frac{3}{16}$ inch.

This handsome oyster occurs in the greatest abundance in fine-grained sandstone, and blue indurated marl, towards the top of the Lower Cretaceous, near Sherman, in the bluffs of Post-Oak Creek, and various other localities in Grayson county. It is found in connection with remains of *Squalidæ*, *Ostrea congesta*, and *Corbula Graysonensis*. Collected by Dr. G. G. Shumard.

ECHINODERMATA.

GENUS CIDARIS.

C. HEMIGRANOSUS, n. sp.

There are several fragments of this remarkably fine Cidaris in the Texas State Collection. The most perfect specimen consists of a double row of interambulacral plates, and one ambulacral avenue. It is sufficiently well preserved to enable us to make out all the essential characters of the species.

The body is large and subspherical. The ambulacral fields are sinuous, depressed below the general surface, and consist of a double alternating series of very short, hexagonal pieces, and of a poriferous avenue on either side. The former are gently convex, somewhat irregular, and each piece terminates outwardly in a small tubercle. The union of the two ranges is indicated by a median shallow linear groove, which is waved and extends the whole length of the field; there is also a similar groove on either side just within the tuberculated margins. The poriferous avenues are much depressed, and rather more than half the width of the non-poriferous space. The pores in a full-grown specimen are transversely elliptical, but in young age circular. The interambulacral plates are large, transverse, and the middle ones more than three times the width of the ambulacral fields. The areolæ are deeply impressed, subcircular, or rather polygonal, and occupy more than half the greatest diameter of the pieces; they are situated nearest the ambulacral side, and in the center each is raised into a somewhat elevated prominence, which supports a smooth, perforated tubercle, surrounded with a deep channel with a sharp border. In most of the specimens under examination the areolar surfaces seem to be smooth, but when unworn they present obscure radiating ridges. Exterior to the areolæ the surfaces of the plates are elegantly ornamented with large, transversely elongated granules, and smaller ones in the intervals, the latter being closely crowded, especially near the margins of the plates.

The *Cidaris hemigranosus* is an unusually large species. One of our specimens when perfect must have exceeded two and a half inches in height, and the transverse diameter was considerably greater.

Form. and Localities.—In the Washita Limestone forming the upper part of the Bluffs of Red River, Lamar County, and ten miles above the mouth of Kiamesha Creek. At both localities it is associated with *Ostrea quadriplicata*.

Notes on the Geology of Kansas and Nebraska.

By Jules Marcou.

[Read June 20, 1859.]

In my "Letter on some points of the Geology of Texas, New Mexico, Kansas and Nebraska" (Zurich, 1858), I say, that the brown sandstones on the Missouri near the mouth of Big Sioux River, containing dicotyledonous leaves, are of Lower Miocene age, or what the German geologists call Oligocene. Messrs. Meek and Hayden, in a memoir entitled "On the so-called Triassic Rocks of Kansas and Nebraska," (Silliman's Jour., Jan. 1859,) say, "it will no longer be doubted that it" (the sandstones with dicotyledonous leaves of Big Sioux River) "really belongs, where we have always placed it, in the Cretaceous System." The opinion of Messrs. Meek and Hayden is based, 1st, upon the fossil leaves; and, 2d, upon the superposition. Now, according to Newberry, the fossil plants, excepting the genera *Credneria* and *Ettingshausenia*, which are Cretaceous, belong to the Tertiary genera; and supposing that these Cretaceous genera had been correctly determined, there would still be more than three quarters of the genera which are clearly Tertiary; and, according to the principles of palæontology, the majority of genera and species should determine the age. Consequently, according to Newberry himself, this Flora is Tertiary and not Cretaceous. But Prof. Heer says, that the supposed *Credneria* is not a *Credneria*, but a *Populus*, which is a Tertiary genus; and that the figure 3, given as *Ettingshausenia* in Silliman's Jour. (March, 1859, p. 223), and accompanying the memoir entitled "Remarks on the Lower Cretaceous Beds of Kansas and Nebraska," by Messrs. Meek and Hayden, belongs not at all to that genus, but to the Tertiary genus *Sassafras*, and, as he himself thinks, is near to *Sassafras Terretianum*, Mass., of Sinigaglia in Italy. So that, according to Heer, all the fossil leaves found in this bed belong to the Tertiary, and, still more, indicate the Lower Miocene or Oligocene.

As to superposition, Messrs. Meek and Hayden have not given a single section showing the superposition of Cretaceous beds above this of the fossil leaves. Slopes and differences of level have never been recognized as indicating superposition with certainty.

That other Tertiary plants exist in Nebraska, entirely different from these, is not surprising, for they belong to other levels. Judging from the collection of Dr. Evans, and some species figured by Dana in the Geology of the Exploring Expedition, Prof. Heer observes, that the fossil Flora of Oregon and Vancouver's Island indicates the Miocene identical with the fresh-water Molasse of Switzerland—that is to say, Middle Miocene.

I will say but a word more upon the last memoir of Messrs. Meek and Hayden, entitled, "Geological Explorations in Kansas Territory," in the Proceedings of the Acad. of Natural Sciences of Philadelphia, Jan. 1859. In this paper, these geologists give a general section of the rocks of the Kansas Valley (pp. 16–18), upon which I desire to make the following observation:—It seems to me, that there must be a discordance of stratification between the numbers 30 and 31; and all the numbers from 31 to 40, instead of being of the Upper Coal Measures, are, for me, of the Upper Mountain Limestone, below the *true* Coal Measures. Between the numbers 30 and 31, there is either a discordance of stratification, or a false concordance.

Remarks on the STRATIGRAPHICAL ARRANGEMENT OF THE ROCKS OF KENTUCKY, *from the Catenipora escharoides horizon of the Upper Silurian Period, in Jefferson County, to the base of the productive Coal Measures in the eastern edge of Hancock County.* By SIDNEY S. LYON.

Having had favorable opportunities of observing the rocks composing the beds which separate the productive Coal Measures from the Upper Silurian beds of Kentucky, especially in that portion of the State lying in a line due east from Owensboro, Davis County, to the outcrop of the Upper Silurian, in Nelson County, and the series forming the upper portion of the section, accompanying this paper, in all the counties in Kentucky which lie immediately adjacent to the coal fields of Hancock, Davis, Henderson, Union, and Crittenden Counties, and its extension southwardly into the counties lying to the south and east of those enumerated, it is proposed to give a more detailed section of the rocks above alluded to than any heretofore made public.

The line of country which would exhibit the necessary natural sections from which the accompanying diagram could be constructed, would begin at Louisville, Jefferson County, when the divisions of the diagram marked *q*, *r*, *s*, *t*, *u*, *v*, *w*, and *x*, are developed and exposed; thence to the southwest, toward Elizabethtown, Hardin County. Between Louisville and Elizabethtown the outcropping edges of the masses marked *q* and *p* would be passed over in ascending series. These masses present themselves on their eastern margin as *the face* of a terrace, on the summit of which spreads out a considerable extent of table and gently undulating land; the eastern escarpment of this table land being notched and worn in many places by the passage of creeks and branches, cutting the entire mass of *p* and part of *o* down to the rocks represented by *q* in the section—in many places making nearly precipitous cuts from 200 to 375 feet. The margin of the mass *p*, and part of the mass *o*, form the inequality in the surface of the country from the mouth of Salt River and along its western side to the head of the Rolling Fork, and it is distinguished as the Muldraugh's Hill Range. Once upon the summit of this range of high land, the country is observed to slope to the west and south, the streams occupying wide shallow valleys. Across this country to Otter Creek, in a direction a little north of west, ten miles distant, the top of the mass represented by *o* will be reached.

From this point toward the west the mass represented by *n* is the surface rock for seven miles, when it disappears under an outlier, composed of the mass of *m*, *l*, and part of the mass of *k*, which cover the country; rising into abrupt hills, or "knobs," having precipitous sides, frequently cut and notched by drains and gullies. The mass of *n* again appears and becomes the surface rock at Big Spring, the corner of Hardin, Mead, and Breckenridge Counties, for several miles toward the west. Three miles west of the head spring of Sinking Creek the upper part of the mass *n* again dips under the bed *m* and the beds above it.

The line of the valley of the Dry Fork of Sinking Creek, from Big Spring to the eastern margin of the beds *m*, *l*, etc., for several miles, is frequently cut into deep gorges and drains varying from 100 to 195 feet deep, exposing good sections of the upper part of *n*.

From a point three miles west of the head of Sinking Creek to the eastern boundary of Hancock County, for a distance of sixteen miles, the masses of *m*, *l*, *k*, *h*, *g*, *f*, *e*, *d*, *c*, and *b*, successively become the surface rock; the last mass (*b*) is found capping a hill 475 feet high, above the water of the Ohio River at Cloverport, six miles to the north of this point. One mile further to the west the base of the productive Coal Measures is reached at the Breckenridge Mines, where the mass of *b* has dipped nearly to a level with the drainage of the country. This last sandstone is the first sandstone mass beneath the celebrated (so called) "Breckenridge cannel coal" * in this part of the country.

To enable the reader to follow the line most favorable for the section, in which all its details can be obtained by actual view, it has necessarily become somewhat crooked. The section itself was traced on a line lying due east and west, as before stated; the measurements verified, corrected, or proved, by all favorable outcrops on either side of the line for several miles, the whole being the result of over eighteen hundred measurements of the outcroping rocks along or near the line of the section as described.

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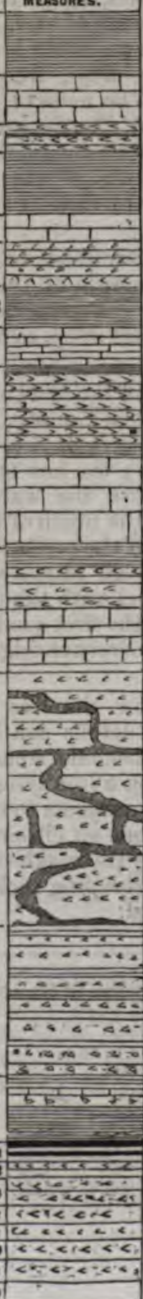
* The Mines are near the county line in Hancock County.

LITHOLOGICAL CHARACTER OF THE SEVERAL MASSES, FROM THE BASE OF a TO x INCLUSIVE.

DIAGRAM.



	FEET.		MEASURES.		
A	1200			*a.* See Rep. Geol. Surv. of Kentucky.	
B	40	200		*b.* 5th Sandstone.	MILLSTONE GRIT SERIES.
C	10	40		*c.* 4th Limestone.	
D	0	84		*d.* Beds of colored clays.	
E	0	6		*e.* 4th Sandstone.	
F	25	50		*f.* 3d Limestone.	
G	0	53		*g.* Aluminous Shale.	
H	25	40		*h.* 3d Sandstone.	
I	20	10		*i.* 2d Limestone.	
K	75	90		*k.* 2d Sandstone.	
L	15	20		*l.* 1st Limestone.	
M	10	30		*m.* 1st Sandstone.	
N	200	400		*n.* Cavernous Limestone.	SUB-CARBONIFEROUS SERIES.
O	500	600		*o.* Middle Limestone.	
P	205	300		*p.* Sandstones and Shales.	
Q	50	100		*q.* Black Slate.	
R	0	8		*r.* Encrinital Limestone.	
S	0	20		*s.* Hydraulic Limestone.	
T	0	3		*t.* Spirifer Bed.	
U	0	2		*u.* Nucleocrinus Bed.	
V	6	10		*v.* Turbo Bed.	
W	5	10		*w.* Coral Beds.	
X	15	40		*x.* Catenipora Beds.	

a. For the details of the mass of *a*, see Reports of the Geological Survey of Kentucky.

b. Fifth Sandstone above the base of the Millstone Grit Division.—This mass is usually a coarse brown sandstone, sometimes containing beds of conglomerate from four to six feet thick, the surfaces of the different beds being sometimes thickly strewn with pebbles; again, large districts of country may be observed where this is the surface rock, and not a single pebble can be obtained derived from it. It is also subject to great variations in thickness even in short distances, the whole mass running sometimes as low as forty, and again thickening up to two hundred feet, and even above the last figures.

c. Fourth Limestone intercalated in the Sandstones of the Millstone Grit Series.—This mass is generally composed of thin-bedded limestones; not unfrequently some thick beds occur near the top of it; these thick beds are generally found to contain great numbers of an undetermined *Belerophon*(?). The mass of *c* is also subject to great modifications both as to the thickness and the character of the materials; in fact, the limestone disappears entirely, and the place of the bed is occupied by aluminous shale, or every conceivable modification of limestone, and earthy limestone, interstatified with marls and thin-bedded clay shale, replaces it. In some districts it is entirely absent, the mass of *b* resting on beds below it.

d. The mass of *d* is a local bed, and is not so regularly persistent over large areas as some of the other beds; it should probably be included in the mass of *c*, which, as a limestone, varies in thickness from ten to forty feet. When the mass of *d* is largely developed, it consists of beds of clay, or thin-bedded aluminous shale, sometimes lying in beds from one to four feet in thickness, differently colored, as yellow, grey; again, yellow, blue, yellow; grey, red, etc.; in different bands, in the order enumerated, from one to five feet in thickness; a repetition of the bands may occur, varying a little in the order of the colors, in the same section. This division of the section is always found thin, or absent, where the limestone *c* is found in considerable force; it varies in thickness from a knife-edge to eighty feet.

e. Fourth Sandstone, Millstone Grit Series.—This is a most remarkable bed, and a good horizon; when present it is always recognizable. It has been traced over large districts of country, and although not always present in its place, having thinned out, it appears in a great number of places, at intervals, along a line a hundred miles in length. It is a hard fine-grained sandstone, always in thin beds; breaks tough, at right angles with the leading faces of the strata, and is of a greenish drab color, and always contains the remains of a small bivalve shell, the internal casts or the vacant spaces which the shells have occupied. It is never (?) more than ten feet thick, thinning to a knife-edge, and disappears in some directions.

f. Third Limestone, Millstone Grit Series.—This mass varies from twenty to fifty feet in thickness, the upper part of it separated from the fourth sandstone by a bed of marly or aluminous shale of greater or less thickness. The whole mass is sometimes found as alternate beds of marly shales, thin-bedded limestone, with sometimes a bed of limestone from two to six feet thick. This mass is particularly distinguished by the remains of the immense number and variety of Blastoidea found in it in certain localities; also by the beauty and variety of its Crinoids; at other localities, by the perfect preservation of its Bryozoa. It is no less remarkable for the paucity of Brachiopoda, etc. *Pentremites sulcatus* (Rœm.) has not been found (by me) in any other horizon than that of the third limestone above. It is worthy of remark that Pentremites do not occur abundantly in this mass with other crinoidal forms, nor are any forms of Radiariæ found in the beds of this mass when the same mass abounds in Bryozoa.

g. Locally, the third limestone has a considerable development; when, beneath it, a considerable bed of aluminous shale is found, this latter mass sometimes rises as high as fifty-three feet, the united thickness of both beds would be over one hundred feet. A locality showing both beds *f* and *g* largely developed is of rare occurrence.

h. Third Sandstone of the Millstone Grit Series.—This is a well defined mass of sandstone from twenty-five to forty feet in thickness, extending without interruption over a great extent of country, in Breckenridge, Grayson, Edmondson, and Ohio Counties. This mass is well distinguished in the three counties first enumerated by some of the beds being blackened by fossil tar. The beds of the whole mass are not all charged with the bituminous deposit, but the beds charged with it are intercalated between beds in which none of it is visible; the beds charged with tar varying from an inch to two feet in thickness and alternating with beds varying in thickness that appear to contain none of it. Some localities exhibit the outcropping edge of the mass entirely covered by the bituminous matter flowing from the beds which contain it over those which do not.

i. Second Limestone of the Millstone Grit Series.—This mass of limestone varies from twenty to forty feet in thickness. Some parts of this mass are frequently oolitic; sometimes it contains regular plates or beds of chert (usually white). The lower part of the mass is frequently formed of alternate beds of marly clay and plates of limestone, while, the middle being oolitic, the upper part is a buff aluminous limestone or indurated clay of a buff color. *Pentremites pyri-*

formis is abundant at almost every outcrop of this mass which has been observed: other forms of *Pentremites* have been observed; these have not been identified. When the place of the buff bed, at the top of this mass, is filled with marly clays, a variety of forms of Blastoidea are abundant and well preserved.

k. Second Sandstone of the Millstone Grit series.—This mass of heavy bedded, coarse sandstone makes permanent cliffs, wherever it has been seen outcropping in Western Kentucky. Locally, fossil tar exudes from the fissures of this mass, but so far as it has been determined, the source of the tar is in Sandstone No. 3 (*h*), and it must find its way downward through the fissures in the masses of *i* and *k*. The "tar springs" of Breckenridge County, Kentucky, are at the base of the mass of *k*, at which point it is eighty-four feet thick. It varies in thickness from 75 to 90 feet, and appears to have been continuous around the coal beds in Western Kentucky.

l. First Limestone of the Millstone Grit Series.—The mass of *l* varies both in thickness and the character of the materials composing it. The remains of the fossils found in it are usually much worn. One outcrop exhibits the upper part of this mass as marly shale mixed with fragments of shells and corals. The general character of the mass of *l* is that of thick beds of lumpy, water-worn limestone. The characteristic fossil of this bed is *Productus*.

m. The First Sandstone and the base of the Millstone Grit Series.—The first sandstone in time rests on the upper part of the limestone variously designated as the "Barrens limestone," "Cavernous limestone," "Carboniferous limestone," "Subcarboniferous limestone," and in Europe as "Mountain limestone." Some American authors prefer the latter designation. The mass of *m* is generally thin-bedded; the strata rarely rise higher than two feet; the upper part of the mass generally consists of the thickest beds; it varies in texture and color, but it is generally found of a light buff color and fine grained. It is not intended that it should be understood that the mass of *m* always rests upon, and is always the capping rock of, the Cavernous limestone of the district treated of. On the contrary, the second sandstone is frequently found resting upon and capping the limestone above alluded to, the masses of *l* and *m* being both absent. This is the case at the entrance of the Mammoth Cave, in Edmondson County, and at many other places. On the road from Madisonville, Hopkins County, to Hopkinsville, Christian County, Kentucky, the mass of *d* of our section is found, at one point, resting on the beds of Cavernous limestone; the part of the latter on which it rests being the equivalent (?) of the beds found 60 miles to the Northeast from this point, in Hardin County, from 275 to

300 feet below the top of the Cavernous member in the latter county.

The beds from the base of the productive Coal Measures (from the top of *b* to the base of *m* inclusive) have been treated of and distinguished in the Reports of the Geological Surveys of Kentucky as the equivalent of the millstone grit beds of European geologists. In Eastern Kentucky, the base of the Coal Measures is well defined by a single bed of coarse sandstone and conglomerate, from 200 to 243 feet thick, while, at the same outcrop, when this sandstone is thus developed, the entire masses represented in our section by the letters *n* and *o*, from 700 to 1000 feet thick, are only one hundred and and eighty-seven feet thick, consisting of limestone and marly shales; and it might with propriety be said, "*this limestone is hardly fossiliferous.*"

n. The Cavernous Limestone.—This mass generally consists of thick beds of close, compact, even-textured, regularly bedded limestone. When this mass has been found in greatest force, the upper one hundred and ninety feet has been found to contain two horizons of beautiful white oolitic limestone. Some of the upper beds of *n*, at certain localities, are principally composed of the remains of *Pentremites globosus* (?) and *P. florealis* Godoni, while the bed next succeeding consists of a mass of shell of *Productus* cemented together. Beneath these latter beds, *Dichocrinus* is the distinguishing fossil for about forty-five feet, with one or two intervals containing vast numbers of *Agassizocrinus*. Near the middle of the mass *n*, there are found, in some localities, beds of chert intercalated with the limestone. These chert beds abound in fragments of reticulated corals, (*Fenestella?*) and a few fragments of shells; the lower part of *n* has not been found to contain any fossils. A more thorough examination would doubtless show their fossiliferous character, and it is possible that this mass may be capable of further subdivision upon the evidence furnished by its fossils alone. The mass of *n* is from 200 to 400 feet thick.

o. Middle of the Subcarboniferous Limestone.—This subdivision of the subcarboniferous limestone is one of convenience alone, the caverns are so extensive and numerous in the mass of *n*, that running water, such as creeks and branches, is unknown above the surface; the rains, being at once swallowed into the caves and "sinks," flow under the ground, occasionally breaking out as an immense spring in the bottom of some deep sink, flowing in the light a few feet, and then again hid in darkness. The top of the mass of *o*, which is composed of alternate beds of limestone and marly or aluminous shale, appears to arrest the downward flow of the water, and thus ends the downward extension of the caverns.

An immense mass of alternate beds of limestone and clays, like the lower part of *m*, has not afforded any considerable fossil remains. The lower two hundred feet of *o*, on the contrary, is as rich in fossil remains as the upper part is barren. About one hundred and eighty feet above the base of *o* lies the equivalent of the "Spurgen's Hill" beds of Washington County, Indiana, which Professor James Hall considers the equivalent of the beds at Warsaw, the beds above Alton, Illinois, and those near Bloomington, Indiana.*

The line of the Louisville and Nashville Railroad, on Clear Creek, Hardin County, gives very satisfactory sections of the lower part of *o*, and the upper part of *p*. The measurements of the mass of *o* have not been entirely satisfactory, owing to the frequent repetition of beds of considerable thickness, which, in the absence of fossils, are hardly distinguishable one from the other. The whole mass is probably from five hundred to six hundred feet thick.

p. Lower part of the Subcarboniferous Series; frequently distinguished as the "Knobstone Beds."—The beds represented by *p* vary in thickness from two hundred and five to three hundred feet on the line of the "Muldraugh's Hill" range. In Eastern Kentucky, the sandy mud beds and sandstone of this bed alone exhibit, at one outcrop of these beds, a section over six hundred feet in thickness, while a considerable portion of the whole series of these beds, at the locality alluded to, is hidden beneath the mass exposed to view. One hundred and twenty feet of the upper part of *p*, in Hardin County, consists of alternate beds of muddy sandstone, aluminous shale, and plates of limestone of variable thickness, variously modified at different localities. These beds are sometimes largely charged with segregations of chert, or interrupted stratified beds of chert; both forms are frequently seen together in the same section. The lower part of the mass of *p*, from 85 to 180 feet in thickness, consists of beds of aluminous shale, with occasionally thin beds of fine grained sandstone, with marly and aluminous shale alternating (locally) near the base of the mass. The upper part of *p* corresponds to and is the equivalent of the crinoid beds near Scottville, Allen County, and the sandy mud beds east of Harristown, on the New Albany and Salem railroad, from one to two miles north of "Spurgen's Hill." The marly beds near the base are known in Bullitt and Jefferson Counties, as "Button-Mould Knob." This horizon is that of the Iron ores of Jefferson, Bullitt and Nelson Counties, Ky.

q. Black Slate.—This mass of bituminous slate, at the base of the "Knob" series, is from 50 to 100 feet in thickness; fossil

* See Transactions of Albany Institute, Vol. IV.

forms have been found in this member in the vicinity of Louisville. Small *Lingulæ* are observed in it toward the south, on Cumberland River, and at several points in Tennessee. The division of the rocks represented by *p* has heretofore been referred to the Devonian period. The propriety of this reference has been questioned.* If the geological divisions are to be made on palæontological evidence, the presence of *Goniatites* in the black slate at Rockford, Indiana, would suggest the reference of this division rather to the Subcarboniferous than to the Devonian epoch.

r. Encrinital Limestone.—This mass consists of several thin beds of limestone, usually about eight feet thick. The upper part is distinguished, in some localities, by the presence of small species of *Productus.* The middle of these beds is literally filled with the remains of *Crinoids* representing a number of genera and species; occasionally a *Pentremite* of true subcarboniferous form has been obtained from these beds, where it is associated with *Eleutherocrinus Cassedayi* (Shum.), *Nucleocrinus* (*Olivanites*) *angularis*, and an undetermined *Platycrinus.* This and the beds represented by *s*, *t*, *u*, *v*, *w* and *x*, thin out rapidly and disappear entirely about twenty miles south of Louisville. It is not proposed, at this time, to refer this bed to any geological age. Further investigation and comparison of its fossils will, at some future period, fix its proper reference much more satisfactorily than it can be done at this time.

s. Hydraulic Limestone Beds.—This mass has a considerable surface extension. At the falls of the Ohio River, it consists of several beds, the entire thickness of the whole mass being about twenty feet. Three miles to the south-east, it has thinned out to four inches.

The prominent fossils distinguishing this bed are *Atrypa prisca*, *Spirifer eurelynes*, *Lucina pura*(?) and *Phacops macropthalma.* The fossil forms of this mass are generally silicified.

t. Spirifer cultragulatus Bed.—At the outcrop on the Ohio River, this bed is about three feet thick; sometimes it is thinner; towards the north-east it is known to be much thicker. The imbedded fossils at the latter point are entire; the locality at the Falls occasionally affords good specimens; generally the valves are separated and water-worn. This spirifer distinguishes this bed, which is the extent of its vertical range. All other fossil forms are absent, or exceedingly rare.

u. Nucleocrinus (*Olivanites*) *Bed.*—This bed is known to have a large surface extension. It is variously modified; at

* See Report of Geological Reconnoisance of Tennessee, by Prof. James M. Safford, 1856.

the falls of the Ohio River, it is usually an earthy limestone about two feet thick, thinning and again expanding in short distances. It is distinguished as the horizon of *Nucleocrinus* (*Olivanites*) *Verneuillii*, a fossil having a limited vertical range.

v. Spirifer grigaria and Turbo (?) *Beds.*—This mass is generally about ten feet thick at one locality, the upper part divided into two distinct horizons of *Spirifer grigaria*, associated with numerous other fossil forms. Beneath the grigaria beds, the mass consists of thick bedded limestone containing broken and water-worn fragments of shells, also fragments and a few teeth of sauroid fishes. This part of the mass of *v* is sometimes distinguished as the fish bed. The Spirifer and Turbo referred to have a limited range and are confined to the upper half of this bed. *Pleurorynchus* occurs occasionally in the lower part of the bed, but it is not certain that the species is confined to it.

w. Coral Beds.—These beds are about ten feet thick at the falls of the Ohio, and are distinguished by the number of the genera and the vast number of the individuals of forms referred to the corals and allied families. Brachiopoda and other forms of shell fish are very rare.

x. Catenipora escharoides Beds.—This peculiar form rises to the base of the mass *w* in considerable quantities; at some localities the surface of the rock at the base of *w* being paved with great plates of it. This fossil is known to have a vertical range in the vicinity of Louisville of about forty feet.

Occasionally, small specimens have been found in the top of the mass of *u*. These are however water-worn and may have been deposited in this latter bed, long after the animal producing it had ceased to exist. It may have been washed from the beds long previously deposited, and which were suffering denudation and waste, during the period of the deposition of the beds represented by *x*.

The divisions of the lower part of the foregoing section are those which naturally present themselves to the collector of their fossil remains.

At some future period, it is proposed to refer to the several beds enumerated all the fossils peculiar to each, as well as those whose range extends through one or more of the divisions; also to make further divisions in some of the masses in which beds of a local character are found.

Should this section prove useful to the student of Geology, the aim of the author will have been accomplished.

Notice of Meteoric Iron *from Texas.* By B. F. Shumard, M.D.

The interesting specimen of meteoric iron we are about to describe is preserved in the State Geological Cabinet at Austin, where at our earnest solicitation it was deposited by the late Maj. R. S. Neighbors, U. S. Indian Agent, who obtained it during the month of May, 1836, from the eastern side of Brazos River, about sixty miles from the Comanche Reserve, in lat. 34°, long. 100°.

The history of this meteorite as furnished by Maj. Neighbors is in substance as follows.

For many years its existence was known to the Comanches, who regarded it with the highest veneration, and believed it possessed of extraordinary curative virtues. They gave to it the names *Ta-pic-ta-car-re* (Standing Rock), *Po-i-wisht-car-re* (Standing Metal), and *Po-a-cat-le-pi-le-car-re* (Medicine Rock), and it was the custom of all who passed by to deposit upon it beads, arrow-heads, tobacco, and other articles, as offerings.

According to the Indians the mass was first discovered by the Spaniards, who made several ineffectual attempts to remove it on pack-mules, but were finally compelled to abandon it on account of its great weight.

The Comanches at first endeavored to melt the mass by building large fires around it, and failing in this, they next attempted to break it in pieces, in which they were likewise unsuccessful; they then conceived the idea that it was a wonderful medicine stone, and therefore worthy of their most profound regard.

When the meteorite was conveyed to the Indian Reserve, the Comanches collected in great numbers around their valued medicine stone, and whilst manifesting their attachment by rubbing their arms, hands, and chests over it, earnestly besought Maj. Neighbors to permit them to keep it at the agency. The mass was, however, shortly afterwards (July, 1836) taken to San Antonio, where it remained in the possession of Maj. Neighbors until last summer, when it was forwarded by him to Austin.

The present weight of the specimen is 320 pounds, but the original weight was, perhaps, three or four pounds greater, a piece having been cut off from the larger end before it came into our possession. The form is flattened ovoid or truncated pyramidal, with the angles more or less rounded. It measures two feet in length by one foot in width; at the larger extremity the thickness is about eight inches and at the smaller four inches; the surface is marked with irregular,

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An analysis of this iron was made by Prof. W. P. Riddell, in the Laboratory of the Geological Survey, and he has furnished the following statement of its composition:

AUSTIN, TEXAS, *January* 23, 1860.

DR. B. F. SHUMARD,

Dear Sir: Agreeably to your request, I herewith furnish you a statement of the results of my analysis of the meteoric iron, presented to the State Cabinet by the late Maj. R. S. Neighbors:

I. The assay was dissolved in Aqua Regia, which effected a complete solution.

II. The solution was carefully neutralized by Aqua Ammonia, and then an excess of Chloride of Ammonium added.

III. The per oxide of Iron was precipitated by Benzoate of Ammonia.

IV. To the filtrate from III. excess of Caustic Potassa was added to precipitate the oxide of nickel. This precipitate exhibited no trace of Cobalt, as shown by the blow-pipe, &c.

V. The filtrate from IV. was next evaporated to dryness and ignited; the residue redissolved in Aqua Regia and to the solution excess of Potassa added; digested for several hours; precipitate very slight; affording only very faint traces of Cobalt, but decided indications of Nickel.

VI. Miscellaneous qualitative tests were made, which it is unnecessary here to enumerate, as no other ingredients were detected.

The following is the summary of results:

Nickel, - - - -	10.007
Iron, - - - - -	89.993
Cobalt, - - - -	trace
	100.

Respectfully yours,

W. P. RIDDELL.

Since writing the above, the Texas State Cabinet has been enriched with another mass of meteoric iron, somewhat similar in composition to the Brazos specimen, but of much smaller size. All that we have been able to gather of the history of this meteorite is, that it was picked up in Denton county, in the northern part of this State, and thence conveyed by the finder to McKinney, in Collin county, and presented to a blacksmith of that place, in whose possession it remained for several months. In December last, Mr. Higby of McKinney brought me a small hammered specimen of this iron, weighing forty grains. He stated that the mass from which he had taken the specimen weighed about forty pounds when it arrived in McKinney, but that the blacksmith had cut off several pieces, which he had wrought into cane heads and various implements, so that its original size had been very much reduced.

During last winter, Dr. G. G. Shumard procured from the blacksmith a piece weighing twelve pounds five and a half ounces, which after strict inquiry was all that could be found of the original mass.

This piece is of an irregular shape and appears to have formed the middle portion of an elongated mass, though in its present condition we can form no very definite opinion with regard to its original shape. The iron is remarkably close-textured and appears to be quite as malleable as the Brazos iron.

The chemical composition, as determined by Prof. W. P. Riddell, is —

Spec. grav. 7.6698.

Residue insoluble in NO^5 - - - -	0.32814
Iron (mean of three determinations) -	94.02466
Nickel, - - - - - - -	5.42982
Cobalt, - - - - - -	a trace
	99.78262

Descriptions of five new Species of GASTEROPODA *from the Coal Measures, and a* BRACHIOPOD *from the Potsdam Sandstone of Texas.* By B. F. SHUMARD, M.D., *State Geologist.*

PLEUROTOMARIA BRAZOENSIS, n. sp.

Shell small, conical, height a little greater than the width; spiral angle 67°; volutions about seven, flat or slightly concave, marked at base with two revolving carinæ, between which occurs the band of the sinus; lower carina the larger and rounded; under surface of last volution somewhat tumid in the umbilical region, and flattened towards the periphery; suture depressed, linear; aperture subquadrate; columellar lip deflected above and partially closing in the umbilicus, which is very small; surface of volutions ornamented with from thirteen to fourteen rather strong, filiform striæ, which are crossed by sharp transverse striæ, giving to the surface a handsome, crenulated appearance; upper margin marked with a row of rather prominent lengthened tubercles; band of sinus moderately broad, excavated, having a single revolving line, and numerous arched transverse striæ, corresponding in size to those above the band.

Length, 0.32; width, 0.29.

Form. and Loc.—Young County, near the Indian Reserve. Found in bluish-gray marl, associated with *Myalina subquadrata*, *Chonetes mesoloba*, *Straparollus cutilloides*, *Fusulina*, and other characteristic fossils of the Coal Measures. Texas State collection.

PLEUROTOMARIA TENUISTRIATA, n. sp.

Shell small, turreted, conical, height and width about equal; spiral angle 76°; volutions about seven, the last four or five subangulated, and bearing in the middle two small, sharp carinæ, between which is placed the band of the sinus; apicial turns rounded; last volution rounded on the side below the carinæ and convex beneath; suture distinct, linear; umbilicus small and partially concealed by a small, lammellar expansion of the columella; surface ornamented with very fine revolving striæ, which are strongest on the under surface of the last volution; revolving striæ crossed by extremely fine lines of increase, which become thickened at the upper margin of the volutions, forming there a neat crenulated band; band of sinus narrow, depressed, bearing fine, transverse arched lines.

Height and width, 0.35 of an inch.

This is a remarkably neat species and occurs with the preceding in Young County, near the Indian Reserve. Texas State Collection.

PLEUROTOMARIA RIDDELLII, n. sp.

Shell of medium size, regularly conical; base sharply carinated; height a little less than the width; spiral angle 68°; volutions six or seven, flat or very slightly convex, having at base two fine, sharp revolving carinæ, between which is the band of the sinus; last volution flattened convex beneath and forming not quite one half the total height of the shell; suture distinct, depressed, linear; aperture transverse, subquadrate; region of umbilicus deeply excavated; umbilicus small; surface of each volution marked with from twelve to thirteen distinct, rounded, unequal, revolving striæ, which are crossed by sharp, oblique lines, becoming more or less interrupted at the intervals between the revolving striæ, so that under the magnifier they present the appearance of a series of small elongated tubercles; under surface of last volution marked with fine, flexuous striæ, which originate at the umbilicus and radiate to the periphery, where they are strongly curved backwards. There are also obscure revolving lines on this part of the shell. The band of the sinus is rather deeply excavated, and bears closely set arched striæ.

Length, 9 lines; width, 11 lines.

This beautiful shell resembles more closely *P. variata* of De Koninck than any other species known to me. The general form and proportions are similar, but the ornamentation is quite different.

There is only one specimen of this shell in the Texas State Collection. It was found in the Coal Measures of Palo Pinto County, not far from the Brazos River.

Dedicated to its discoverer, Dr. W. P. Riddell, of the Texas Geological Survey.

PLEUROTOMARIA GLANDULA, n. sp.

Shell small, trochiform, conical, subturreted, strongly carinated and angulated at base, obtusely rounded at apex, proportions somewhat variable, usually a little wider than long; volutions about six, flat or very slightly convex, angulated above; last volution occupying about one half the entire length of the shell, under surface moderately convex in the umbilical region, and marked just within the periphery with a more or less distinct revolving depression; umbilicus small, partially closed by the columella, suture not very apparent, linear; aperture subquadrate, surface of volutions ornamented with seven small, sharp revolving lines or carinæ, separated by spaces of unequal width, the lines of the upper part of the volution much closer together than those of the lower, and the band of the sinus being situated between the second and third from the base. The volutions are also marked with numerous sharp, flexuous, transverse striæ, which are interrupted by the carinæ limiting the band of the sinus. The under surface of the body volution is likewise omamented with 12–13 sharp, delicate, revolving lines, and closely-set fine striæ of increase. The band of the sinus is distinctly defined, and exhibits arched striæ, much finer than those of the remainder of the volution.

Length, 0.34; width, 0.36.

Form. and Loc.—Coal Measures, Buchanan County.

Texas State Collection.

MURCHISONIA TEXANA, n. sp.

Shell elongate conical, spiral angle 25°; volutions 13–14, angulated; suture distinct, linear; umbilicus none; aperture rounded, subquadrate, its width and height nearly equal; last volution angulated at base and flattened convex beneath;

surface of volutions marked with a prominent, medium, revolving carina, and two smaller ones above and below; these crossed by a very fine, closely crowded striæ of increase, which are scarcely visible except under a magnifier.

Length, 0.72; width, 0.28.

This species resembles somewhat closely *M. angulata* of Phillips, but is a shorter and more robust species, and the volutions are less sharply angulated.

Occurs in the Coal Measures of Young County, 9 miles east of the Indian Reserve. Texas State Collection.

ORTHIS COLORADOENSIS, n. sp.

Shell small, compressed, subcircular or subquadrate, gently convex, slightly transverse, and a little the widest at the cardinal margin; front more strongly rounded than the sides. Dorsal valve a little more convex than the ventral, greatest convexity near the beak; sinus rather deep, well defined, commencing at the beak and gradually widening to the front, where its width is equal to about one third the transverse diameter of the shell; beak small, pointed, scarcely passing beyond the cardinal margin; area narrow, foramen triangular, moderately wide. Ventral valve having a slightly raised, but rather broad mesial elevation, which is most prominent near the beak, and in some specimens its lateral margins are bounded by a raised line; beak small, not prominent, passing a little beyond the cardinal edge. Surface of valves neatly ornamented with very fine, closely crowded, concentric lines, crossed by about thirty, rounded radiating striæ, which are sometimes simple and sometimes bifurcated.

The dimensions of the largest specimens I have seen are, length, 0.50; width, 0.58; but most of the specimens before me are about one third smaller. The radiating striæ are occasionally nearly obsolete, but the concentric always distinct.

The general form of this shell is very similar to a species in my cabinet from the Potsdam Sandstone of Minnesota, which, however, has only been found as casts in fine-grained sandstone, so that we cannot draw a satisfactory comparison.

Form. and Loc.—Found in greenish gray calcareo-silicious sandstone of the age of the Potsdam Sandstone of the New York Series, near the head of Morgan's Creek, Burnet County. Texas State Collection.

Descriptions of Four new species of BLASTOIDEA, *from the Subcarboniferous Rocks of Kentucky.* By SIDNEY S. LYON.

In the third volume of the Geological Reports of Kentucky, published in 1857, page 1469, a new formula was proposed for the Genus Pentremites. Investigations carried on since the publication of that formula have strengthened the opinion, then entertained, of the propriety and necessity of a change in the technical formula of this genus, which had been generally accepted by authors previous to the publication of the report alluded to. The following descriptions being based on the proposed formula referred to, it is thought proper to repeat it in this place.

GENUS PENTREMITES, *Say*.

GENERIC FORMULA.

Basal pieces 1×3, short, broad, nearly equal in size; first radial pieces 1×3, two hexagonal, perfect, one pentagonal, imperfect; second radial pieces 1×5, nearly equal in size, long, forked; interradial pieces 1×5, small, lanceolate, equal in size; pseudambulacral fields 1×5, long, filling the forked second radials, and terminating at the mouth; mouth 1, central (at the summit); ovarian opening 2×5, situated around the mouth; column cylindrical, perforated, segments of equal size and thickness.

PENTREMITES CALYCINUS, n. sp.

(Plate XX., Fig. 1a, 1b, 1c.)

Body calyx-formed, the summit to the lower part of the pseudambulacral areas being nearly hemispherical, the lower part from thence to the junction of the base with the column having the form of an inverted pyramid. *Basal pieces* three, prominent, projecting beyond the lower margins of the first radials and the column. *Columnar articulation*, on the base depressed, concave, considerably less in size than the joined basal pieces. *First radials* three, twice as broad as high, the perfect first radials supporting the second radials upon a squarely truncated surface, forming a deep notch above their junction with each other, and on the side to the right of the imperfect first radial; the junction on the other side slightly angular or concave. *Second radials* five, broad, short, very prominent at the base of the pseudambulacral areas, increasing in width from below upwards, curving rapidly towards the central axis from the lower part of the fork to the summit, obliquely truncated for the reception of the interradial pieces. *Interradial pieces* five, triangular small, short, and for their length very broad. *Pseudambulacral fields* five, broad, diminishing by a curved line on either side from above downwards, acutely pointed below, filling the fork and rising nearly as high as the radial and interradial pieces at their margin, less than half the length of the specimen; the poral pieces filling these fields, thin; about 100 measuring an inch, from 38 to 39 in either side of each field in the specimen figured, separated by a slight but well defined line in the middle of each field; the line separating either side of the fields into two divisions, is only visible by the aid of a good lens. *Ovarian openings* five; four of the pseudambulacral fields terminate at a minute circular opening, the other field terminating at an ovoid opening about four times as large as either of the others. This last opening occupies the summit of the field, the first to the right hand above the imperfect first radial. *Mouth* small, central, at the summit irregularly stelliform.

Surface markings, if any, obliterated by the mineralization of the specimen; it is silicified.

The general form of *P. calycinus* approaches that of *P. D'Orbignyanus* de Koninck, and belongs to Rœmer's division *florealis*.

Geological position and Locality.—A single entire specimen and two fragments were procured from the upper part of the second limestone of the Millstone-grit beds, near Eskridge's ferry in Grayson County, Ky. It is not impossible that its horizon is in the third limestone of the beds alluded to; no specimen or fragment of one could be seen in place in either bed. It must be very rare.

Size of the Specimen.—Length of specimen, $\frac{65}{100}$ inches; greatest diameter, $\frac{60}{100}$; vertical length of pseudambulacral areas, $\frac{30}{100}$; greatest length of first radial pieces, $\frac{15}{100}$; greatest length of second radial pieces, $\frac{30}{100}$; greatest length of basal pieces, $\frac{10}{100}$; length of interradial pieces, $\frac{15}{100}$. The drawing represents the specimen a little too full at the base of the pseudambulacral areas.

PENTREMITES ROBUSTUS, n. sp.

(Plate XX., Fig. 2a, 2b, 2c.)

Body symmetrical, ovoid above the lower limit of the pseudambulacral fields; contracting suddenly from thence to the upper margin of the first radials. *Basal pieces* three, very minute; perforation small, round. *First radials* three, small compared with the rest of the body, centrally prominent, depressed at the sutures marking their junction with the basal pieces, the second radials, and with each other, forming a prominent cup pentagonal at its upper margin; the sides slightly indented, curved, or straight; to which are joined the *Second radial pieces*—these extend outward nearly at right angles with the perpendicular axis, to the lower termination of the pseudambulacral areas, sharply curving outward at their junction with the margin of these areas; truncated at their upper extremity by a sigmoid line for the reception of the interradial pieces; marked by faint longitudinal striæ which increase in size and distance from each other near the base of the interradial pieces, where they obliquely cross the pieces. *Interradial pieces* five, very long and large, laying nearly on a plane with the poral pieces of the pseudambulacral areas, sharply pointed at the line dividing the second radials to which they unite on either side by a double curved line. *Pseudambulacral fields* very long, being equal to six-sevenths of the vertical height of the specimen. The poral pieces composing the fields are quite thin, there being one hundred and one to each side of the line dividing the field, and two hundred and two to the whole field, which is one inch and one-tenth in length. The pieces are divided into four longitudinal bands to each field, those joining the central suture being considerably wider than those on the outer margins of the fields. The margins of the fields are nearly parallel to each other and about two-thirds their length, when they approach each other gradually by a curved line at the lower end of the field. The poral pieces are prominent, rising above the plane of the second radial pieces, and as high as their curved margins; disposed in the field at right angles with the vertical axis of the body, slightly curved, thus swelling the field on either side of the central suture, which is small and slightly depressed. *Ovarian openings* five, large, nearly equal in size, circular; the largest one ovoid, and placed at the summit of the field; the second on the left hand above the imperfect first radial* piece; all the ovarian openings are divided centrally, the branches extending into the body on either side of the interradiated pieces in a line immediately under the line dividing the poral pieces of the pseudambulacral fields. *Mouth* central, at the summit, small, irregularly stelliform. *Column* very small, round, composed of pieces of equal thickness.

All the main pieces composing the body are of remarkable thickness and strength; the interradial and second radial pieces are fifteen-hundreths of an inch in thickness, in a medium sized specimen.

* The relative position of the largest ovarian (?) opening in *Pentremites* differs in different species.

The general form somewhat resembles that of *P. florealis;* the size of the species and the sigmoid sutures dividing the second radial from the interradial pieces forbid the supposition that it should ever be confounded with that species.

Geological position and Locality.—*P. robustus* has been obtained from a single locality only, in the marly shale beds at the top of the third limestone of the Millstone-grit beds of Grayson County, Ky. At this locality the fifth sandstone of these beds rests on the shale beds, in which it was obtained, the other beds usually found between the beds above referred to being absent at this locality. It is, moreover, worthy of remark, that, at some hundred natural sections into the third limestone and the beds above it for several miles to the east and south, are found only Bryozoa and Corals, with occasionally separate joints and fragments of crinoidal columns.

Size of Specimen.—Greatest length, $1\frac{30}{100}$ inches; greatest diameter, $1\frac{20}{100}$; vertical length of pseudambulacral areas, 1.00; vertical height of basal and first radial pieces, $\frac{25}{100}$; length of interradial pieces, $\frac{50}{100}$; width of interradial pieces, $\frac{25}{100}$; greatest length of second radials, $\frac{05}{100}$; greatest width of second radials, $\frac{60}{100}$. Specimen medium size.

PENTREMITES ANGULARIS, n. sp.

(Plate XX., Fig. 3a, 3b, 3c.)

Body subglobose, truncate at the summit, elongated and angular below. *Basal pieces* thin, large, prominent and well defined. *First radial pieces* thin, the imperfect radial very large, being as wide as the perfect radials; ray-bearing margin of perfect radials concave, angular notches between the pieces deep, the center of the pieces full and prominent, the upper and lateral margins of the pieces depressed, renders the cup very prominent. *Second radials* five, long, forked three-fifths their length, expanding from both ends to the center; greatest breadth at the lower end of the pseudambulacral fields; obliquely truncated above. *Interradial pieces* five, lozenge-shaped, very minute, extending nearly as high as the summit of the poral pieces. *Pseudambulacral fields* five, broad, gradually expanding from below upwards; widest at the summit of the interradial pieces, angularly depressed from the sides to the line dividing the field; center grows shallow below, gradually deepening toward the summit, forming a sharp angular notch, which is deepest opposite the center of the interradial pieces. *The poral pieces* extend above the upper extremity of the interradials, the whole number on either side of the field being about seventy-six, seven of which are above the points of the interradials. *Ovarian open-*

ings five, divided in the center, depressed below the poral pieces at the summit; four are irregular in form and small; the fifth is about twice the diameter of the others and ovoid. *Mouth* central, stelliform. The side on which the largest ovarian opening is situated is more full than the other sides; this fullness renders the species unsymmetrical; the large opening is situated at the summit of the field, the second to the left, above the imperfect first radial. The inequality of the sides renders the species unsymmetrical. In *P. Cherokeeus* (*sulcatus*), Troost, the fullness in the sides is exactly opposite the large ovarian opening.

P. angularis somewhat resembles *P. Cherokeeus* (*sulcatus*, Rœm.) from which it differs in the minuteness of the interradial pieces, which are not prolonged as high as the poral pieces, in being more pyriform below, the pseudambulacral areas more erect and less contracted toward the summit, their greater breadth, less length in proportion to the size of the specimen, and the greater thickness of the poral pieces, also by the prominence of the basal pieces* and first radial pieces. The outline of a transverse section of *P. angularis* is quite different from the same section in *P. Cherokeeus;* in our species, the outline is a plain pentagon with the angular points rounded; while in *sulcatus*, the second radials are joined together in a deep circular groove, equal in depth to one-fifth of the diameter of the species, at the opposite grooves at its greatest transverse axis.

Geological position and Locality.—*P. angularis* was obtained from a (local) silicious mud-bed at the Falls of Rough Creek, Breckenridge County, Ky. Rough Creek, at the Falls, cuts and exposes the equivalent of the beds of the third limestone of the Millstone-grit of this part of Kentucky. Our species, although carefully sought for, has not been obtained from any other locality; at the Falls of Rough Creek, it has a vertical range of about fifteen inches. The beds at this locality are subject to frequent, sudden, and entire changes in mineral character, in the space of a few inches.

Size of Specimen (medium-sized adult ?).—Greatest length $\frac{35}{100}$ inches; greatest diameter, $\frac{10}{100}$; greatest length of basal pieces, $\frac{15}{100}$; greatest length of first radials, $\frac{15}{100}$; greatest length of second radials, $\frac{70}{100}$; greatest length of interradials $\frac{8}{100}$.

PENTREMITES ELEGANS, n. sp.

(Plate XX., Fig. 4a, 4b, 4c.)

Body pyriform, greatest diameter a little below the center of the length of the body, diminishing very rapidly from the

* The term basal pieces is here used in a different sense from the same term as used by authors *in generic formula*.

greatest diameter to the summit of the first radials, then gradually tapering to the column; above the base of the pseudambulacral fields, gradually tapering to the summit by curved lines; summit truncated, plane. *Basal pieces* thin, long, and narrow, the suture marking the separation between them and the first radials quite distinct; the points of the pieces at their junction with each other, much longer than in any other species observed. *First radials* thin, long and narrow; angular depression on either side of the imperfect first radial and at the junction of the perfect radials, deep; summits of the perfect radials concave. The first radials with the basal pieces forming a deep narrow cup. *Second radials* five, narrow, very prominent at the base of the pseudambulacral areas; furcation broad and deep, dividing the second radials two-thirds their length, obliquely truncated at the summit for the reception of the interradials; the line joining the lateral margins of the pieces deeply depressed and angular below the middle of the species, and very slightly depressed from thence upwards. *Interradial pieces* five, small, obtusely angular below, acutely angular and much prolonged above, being twice as long above their line of junction with the second radials as they are below it. All the pieces surrounding the pseudambulacral fields are nearly on a plane with the poral pieces, being however distinctly separated from them by a sharp groove filled with elongated perforations, which lie in a line with the depression marking the division of the poral pieces themselves, and not, as is usually the case, at the end of the fullest part of the end of the poral pieces. *Ambulacral areas* five, broad, a little more than half the length of the species; rounded below, expanding to the base of the interradials, slightly contracted at the summit, beyond which they extend the distance of the thickness of seven or eight poral pieces. *Poral pieces*—these pieces are very thin and delicately formed, disposed in the field with its transverse axis; they number sixty-three on either side of the field; the line dividing the sides of the field very obscure, although the pieces are well preserved, sufficiently so as to exhibit with a good lens, that the line at which the sides of the poral pieces is joined is sharply and distinctly serrated; median line of field of medium depth, outline margins of field slightly rounded at the pores; the poral pieces then fall to the center of the field in a straight line, thus making the center of the field a wide, obtuse angle. *Ovarian openings* five, large, widely disposed, differing in size, separated by a septum, deeply seated within the opening; the opening a little the largest is at the summit of the field, the second to the left of the upper margin of the imperfect first radial.

P. elegans approaches in form somewhat to that of *P.*

Descriptions of New Fossils from the Carboniferous and Devonian Rocks of Missouri. By G. C. SWALLOW, *State Geologist.*

BRACHIOPODA.

STROPHODONTA NAVALIS, n. sp.

Shell rather large, thick, semielliptical, carinate, punctate, costate. Ventral valve very convex, obtusely carinated, somewhat flattened towards the lateral margins; strongly arched from the beak to the middle, with a more gentle curve towards the anterior margin, where the carina is somewhat depressed and rounded; beak small, incurved slightly beyond the cardinal border; umbo large, projecting slightly beyond the cardinal border; ears distinctly defined and strongly arched towards the area; area straight, linear, common to both valves and vertically striate. Dorsal valve very concave, closely following the curvatures of the ventral, recurved along the cardinal margin, forming the concave surface of the ears; cardinal line as long or longer than the width of the shell. Surface marked by numerous subirregular, rounded, granular, radiating plications; but few originate at the beak of the ventral valve; the number is increased by subdivisions and implantations. The punctate structure is very obvious where the shell is worn or exfoliated.

Length, 1.40;* breadth, 1.44; depth of ventral valve, .61.

The *variety subnavalis* is larger, less carinated, and more regularly arched.

From the base of the Devonian rocks in Callaway county.

STROPHODONTA CYMBIFORMIS, n. sp.

Shell semiellipsoidal, auriculate and costate. Ventral valve very convex, subcarinate, highest near the center; curvature increased regularly from the anterior margin to the beak; flattened towards the lateral margins and sharply rounded along the middle; umbo large, projecting beyond the cardinal line about one-fourth the length of the shell; beak small, strongly recurved, scarcely modifying the area; area straight, narrow, and much impressed; cardinal line as long as the width of the shell. Dorsal valve semielliptical, very concave, with a deep rounded sinus in front to fill the corresponding elevation in the opposite valve; the lateral edges recurved and arched to meet the impressed cardinal border, and form the sinuses leading from the central cavity

* The measurements in this paper are in inches.

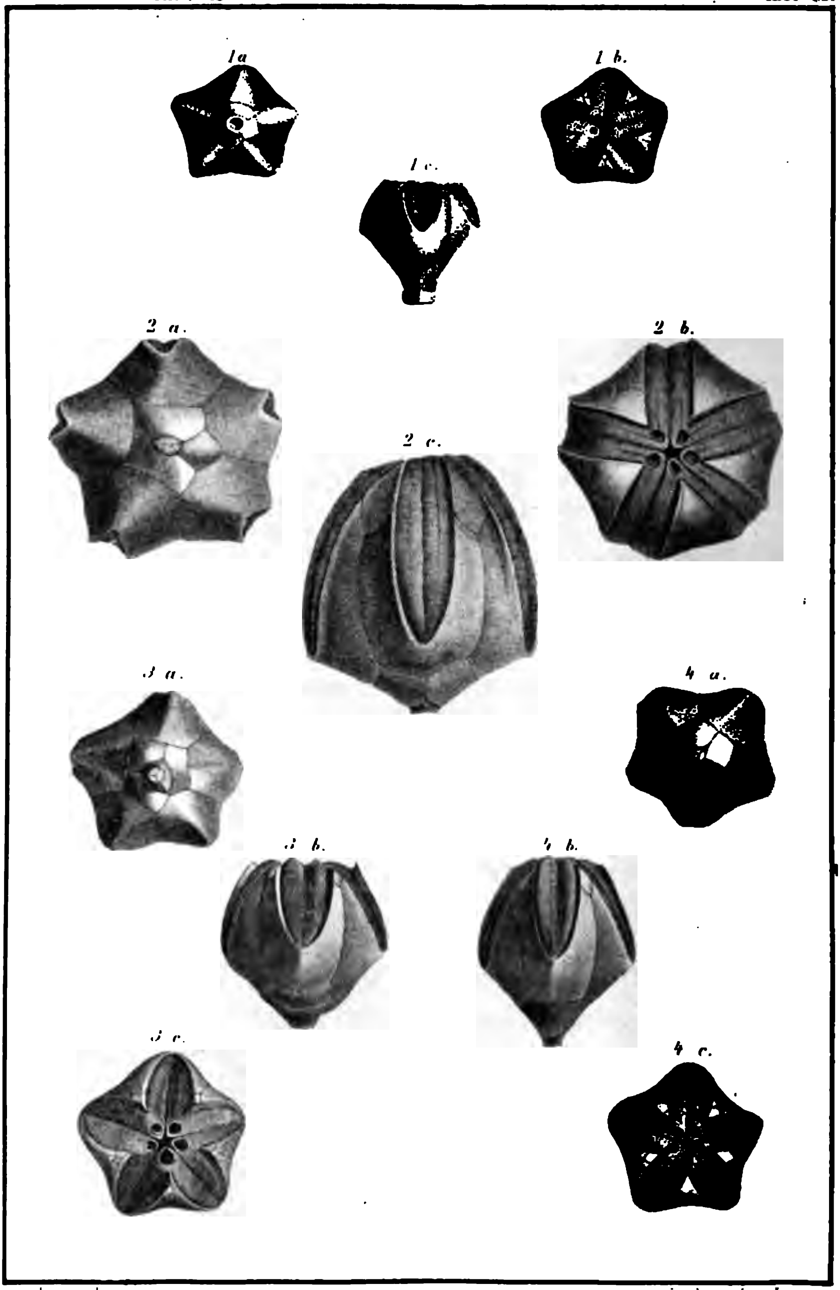

Fig. 1 Pentremites calycinus
1 a Profile View
1 b Summit View
1 c Basal View.

Fig. 2 Pentremites robustus
2 a Profile View
2 b Summit View
2 c Basal View.

Fig. 3 Pentremites angularis
3 a Basal View
3 b Profile View
3 c Summit View.

Fig. 4 Pentremites ele
4 a Basal View
4 b Profile View
4 c Summit V

gularly convex; associated with the last, in the rocks of Callaway county.

STROPHODONTA INFLEXA, n. sp.

Shell semiellipsoidal, but a little wider in front, regularly arched and coarsely costated. Ventral valve very convex, semiellipsoidal, wider in front, highest near the center—regularly arched to the anterior margin, more abruptly at the posterior extremity, and somewhat flattened near the beak—very regularly arched transversely, but most abruptly on the obsolete mesial fold; ears very small, or obsolete; beak small, depressed; area straight, narrow, impressed, and common to both valves; umbo large and prominent. Dorsal valve semielliptical, less convex, slightly depressed in front; lateral edges recurved and slightly arched where they meet the cardinal line; cardinal line as long or shorter than the width of the shell, situated about one-third of the length of the shell from the posterior extremity. Surface marked with large subangular, unequal, irregular, granulated costæ, increased by implantations and subdivisions; structure punctate.

Length, 1.41; breadth, 1.21; depth of ventral valve, .83.

This species most resembles *S. cymbiformis;* but it is less convex, wider, and is marked with much larger costæ—about 26 on the ventral valve.

From the base of the Devonian rocks in Callaway county.

STROPHODONTA ALTIDORSATA, n. sp.

Shell small, very convex, semielliptical, (triangular when young,) auriculate. Ventral valve very convex, much raised and rounded from the beak to the anterior margin; raised portion ovate, highest near the middle, whence it is regularly arched towards the anterior margin, but more abruptly towards the ears; umbo prominent; beak strongly incurved, projecting a little beyond the cardinal margin; area straight, narrow, impressed, widest in the middle, and tapering towards the extremities, transversely striated, shorter than or equal to the width of the shell; ears large, well defined, triangular and arched. Dorsal valve very concave, following somewhat the curvatures of the ventral; strong folds extend from the beak to the lateral margins, defining the ears; a crenulated fold marks the straight cardinal border; lateral margins turned down, and arched to meet the cardinal border and form the large ears; anterior margin depressed, forming a broad rounded sinus. Surface marked with numerous small, rounded, granular, radiating plications, by obsolete, concentric striæ, and by a few lamellar concentric folds; the radiating plications are increased by implantation;

a few rugose plications curve around the boundaries of the ears on the ventral valve.

Length, .89; breadth, .83; height of ventral valve, .55.

From the Lower Devonian rocks of Callaway county.

STROPHODONTA BOONENSIS, n. sp.

Shell hemispheroidal. Ventral valve regularly convex, slightly raised along the mesial line; umbo depressed, scarcely modifying the curvature of the valve; beak small, slightly incurved over the area; area straight, narrow, impressed, striated vertically, about as long as the width of the shell; ears small, indistinct. Dorsal valve less convex, semielliptical, depressed in front; lateral margins recurved to meet the cardinal border. Surface marked with large rounded, radiating plications, (which are sometimes angular, irregular and unequal,) increased by subdivisions and implantations.

Length, 1.12; breadth, 1.20; depth of ventral valve, .65.

This species most resembles *S. inflexa;* but is shorter and less convex.

Associated with the last six species in the Lower Devonian rocks of Callaway county.

STROPHODONTA CALLAWAYENSIS, n. sp.

Shell semi-elliptical, margin regularly curved from the anterior margin to the cardinal extremities. Ventral valve very convex from the middle towards the beak; somewhat flattened towards the anterior and lateral margins; the convex or raised portion broadly ovate; ears large, well defined, and arched towards the cardinal border; extremities recurved towards the center of the valve; area common to both valves, wider in the middle, as long or shorter than the width of the shell; umbo large, prominent. Dorsal valve concave, following the curvatures of the opposite valve; lateral portions, towards the cardinal line, curved down and arched to form the concave suface of the ears; cardinal border crenulated. Surface marked with numerous small, rounded, granulated, radiating costæ, and by fine concentric striæ and lamellar imbricating bands, which are most abundant near the margins.

Length, 1.30; breadth, 1.35; depth of ventral valve, .52.

This fossil most resembles *S. demissa* of Conrad; but it is more convex, its ears are better defined and less prolonged on the cardinal line. It may be distinguished from *S. æquicostata* by its larger and better defined ears, and by the ovate form of the convex portion of the ventral valve.

From the Hamilton rocks of Callaway county.

STROPHODONTA QUADRATA, n. sp.

Shell moderately convex, subquadrangular or semi-elliptical, auriculate. Ventral valve highest near the middle, most abruptly arched towards the beak, flattened towards the margins; ears scarcely defined by an obsolete depression and by the sinuses on the lateral margins, large, triangular, and acuminate at the outer extremity; umbo rather depressed; beak small; area straight, narrow, widest in the middle, longer than the width of the shell. Dorsal valve less convex, depressed in front, with a sinus extending into each ear. Surface marked with numerous fine radiating striæ; the spaces between the striæ ornamented with rows of small pits, which become more obvious when the shell is worn or exfoliated.

Length, 1, breadth, 1.12; depth of ventral valve, .35.

This shell may be known by its subquadrate form, surface markings, and its gradual slope from the highest part of the ventral valve to the beak.

From the Hamilton rocks of Callaway county.

STROPHODONTA ÆQUICOSTATA, n. sp.

Shell suborbicular, auriculate, with a sinus on each lateral margin anterior to the ears. Ventral valve subsemihemispherical, regularly convex, but most arched between the beak and the center; ears defined by a depression on this valve and the sinuses on the lateral margins; they are arched and but slightly change the regular contour of the valve; area straight, narrow, vertically striated, and common to both valves; umbo depressed; beak small, depressed. Dorsal valve very concave, following closely the curvature of the opposite valve, much flattened towards the cardinal border; lateral edges depressed and arched to form the concave surface of the ears; cardinal border slightly arched and finely crenulated. Surface marked by numerous small, rounded, granulated, radiating plications, and by very fine concentric striæ, and imbricating plications of growth.

Length, 1.18; breadth, 1.45; depth, .53; cardinal line, 1.20.

From the Hamilton Group, in Callaway county.

ORTHIS MISSOURIENSIS, n. sp.

Shell small, resupinate, suborbicular, plicated. Ventral valve convex, flattened and depressed in front; beak large, pointed, incurved; area triangular, arched; foramen triangular, base shorter than the sides. Dorsal valve more convex, somewhat flattened towards the border; beak about as long as that of the opposite valve; hinge line about two-thirds as long as the width of the shell. Surface marked with small, rounded, bifurcating plications, rendered granulose by obsolete concentric striæ.

Length, 1.12; width, 1.09; thickness, .43.

This fossil most resembles *O. Vanuxemi* of Prof. Hall; but it is more convex towards the beaks, and more flattened towards the anterior border; has a wider area and much finer striæ.

Rare in the Chemung rocks of Cooper and Marion counties.

Productus Callawayensis, n. sp.

Shell small, thin, depressed, spinose, varying from semi-orbicular to suborbicular. Ventral valve very regularly convex, but most so on the umbo, flattened towards the ears; beak small, incurved to or slightly over the cardinal line; umbo small, prominent, projecting a little back of the cardinal line; ears large flattened triangular, slightly arched towards the cardinal line, rounded on the outer angle; mesial sinus obsolete, or entirely wanting. Dorsal valve regularly concave, most depressed in the middle in adult specimens, but nearer the beak in the young; ears well defined, triangular, slightly arched; cardinal line as long or shorter than the width of the shell; curved at the extremities towards the lateral margins and down towards the center of the ventral valve. Surface marked with small, irregular, interrupted corrugations and striæ; both valves thickly set with depressed spines, whose bases are more or less prolonged into longitudinal plications; spinus on the dorsal valve, smaller.

Length, .85; breadth, 1.12; thickness, .40.

Abundant in the Lower Devonian rocks of Callaway county, associated with *Nautilus Lawsii*, *Strophodonta navalis*, and *S. Kemperi*.

Productus Copoerensis, n. sp.

Shell small, elongate, obsoletely plicate and strongly arched. Ventral valve much elevated, elongated, strongly recurved, bringing the hinge line near the middle of the shell; hinge line longer than the width of the shell; ears flattened, thin, arched towards the cardinal line. Dorsal valve concave, anterior margin produced; plane of the visceral region at right angles to the anterior prolongation. Surface of visceral region marked with irregular, concentric corrugations, and by broad, unequal, irregular, obsolete, longitudinal folds. Whole surface ornamented with fine concentric striæ and a few scattered spines.

Length, .75; breadth, .58; thickness, .41.

This shell most resembles the *P. arcuatus* of Prof. Hall, but it is easily distinguished by its obsolete plications, and the greater length of its cardinal line.

Abundant in the Chouteau Limestone of Cooper county.

PRODUCTUS MAGNICOSTATUS, n. sp.

Shell of medium size, strongly enrolled, coarsely costate, valves much produced. Ventral valve very convex, much produced and flattened in front; mesial sinus obsolete; hinge line produced into auricular appendages; ears large, arched. Surface marked with large, high, unequal, rounded, longitudinal plications, which are increased by subdivisions; the visceral portion is also marked by similar transverse plications, which are, however, more regular; the anterior portion of the valve is marked by numerous fine, transverse rugæ; a few large spines are scattered over the visceral region, with one or two rows on each ear; dorsal valve not seen.

Shell is distinguished from all our Producti by its larger and more elevated plications.

Found by Dr. Norwood, in the Coal Measures of Johnson county.

SPIRIFER ANNÆ, n. sp.

Shell very small, sub-semipyramidal. Ventral valve semipyramidal; slightly arched from the beak to the anterior and lateral margins; area high, arched, triangular; sides shorter than the base on the cardinal line; beak small, pointed, and slightly incurved; mesial sinus simple, well defined, concave, or flattened at the bottom; foramen narrow. Dorsal valve semicircular, slightly convex, flattened towards the cardinal extremities; mesial fold sharply defined, depressed, simple; beak small, slightly incurved over the cardinal line; cardinal line as long or shorter than the width of the shell. Surface marked with from six to ten plications on each side of the mesial sinus and fold, and by numerous concentric imbricating lamellæ.

Length, .25; breadth, .33; thickness, .20.

In the Hamilton rocks of Callaway county, with *Spirigera Fultonensis*.

SPIRIFER OSAGENSIS, n. sp.

Shell below the medium size, gibbous, triangular and transverse. Ventral valve very convex—from the highest point near the beak it arches regularly to the anterior and lateral margins, but more abruptly towards the cardinal extremities, which are separated from the body of the valve by oblique depressions; sinus defined by an angular ridge on each side, simple at the beak and marked by from five to seven plications at the anterior margin—the central plication is implantlarge, triangular, equilateral; umbo large; beak pointed, strongly incurved. Dorsal valve less convex, elliptical, flattened toward the cardinal extremities, mesial fold scarcely defined, slightly raised and rounded in front; beak small, slightly incurved; hinge line short, about one-third the width of the shell. Surface ornamented with large concentric folds, marked with small pits and short longitudinal plications.

Length, .50; breadth, .55; thickness, .32.

This shell very much resembles *Spirifer lineatus* of Verneuil, as figured in the Geology of Russia, and *S. perplexa* of McChesney; but its beak is smaller and its concentric folds larger and very differently marked.

Very abundant in the Chouteau Limestone of Cooper county.

SPIRIFER VERNONENSIS, n. sp.

Shell of medium size, transverse, semiorbicular. Ventral valve convex, highest near the beak, whence it is regularly arched to the margins, flattened near the cardinal extremities; sinus deep, angular, widening rapidly to the anterior margin, simple and distinct at the beak, but marked with plications which increase by subdivisions towards the anterior margin, where they number from eight to ten; beak rather small, pointed, and strongly incurved; area subtriangular, very concave, striated; foramen triangular, nearly equilateral; dorsal valve convex, nearly as large as the ventral, highest near the middle, and flattened near the cardinal extremities; mesial fold sharply defined, high, subcarinated or rounded, slightly recurved at the anterior margin, simple at the beak, but marked with successive subdivisions until they reach the number of eight or ten, at the anterior border; hinge line straight, and more or less prolonged into alate or mucronate extremities; beak strongly incurved, but scarcely beyond the cardinal border. Surface marked with about eighteen simple rounded plications on each side of the mesial fold and sinus; they originate on the beaks and on the borders of the area near the beaks; those near the cardinal extremities are much smaller; it is also ornamented with numerous fine concentric imbricating lamellæ, and distinct lines of growth.

Length, 1.12; width, 1.60; thickness, .77.

From the Chemung rocks of St. Louis county.

Variety *Ozarkensis* is much more angular, sinus more deeply impressed, cardinal extremities more extended, and the plications on each side of the mesial fold and sinus are often subdivided.

From the Chemung rocks of Taney county.

SPIRIFER TANEYENSIS, n. sp.

Shell very small, gibbous, subglobular, strongly plicate, cardinal extremities produced, submucronate. Ventral valve very gibbous, strongly arched from the beak to the anterior margin; area long, narrow, arched; foramen small; beak large, strongly incurved; mesial sinus well defined, deep, narrow, simple. Dorsal valve smaller, less convex, more depressed towards the cardinal extremities; umbo large; beak small; mesial fold simple, narrow, high and rounded; cardinal line longer than width of shell, extremities arched towards the umbo of the dorsal valve. Surface marked with from four to six simple, rounded plications, on each side of the mesial fold and sinus; those on each side of and next to the mesial sinus, much larger and higher; those on the dorsal valve larger and one or two less in number. It is also ornamented with numerous concentric subimbricating lamellæ.

Length, .38; breadth, .52; thickness, .32.

This little fossil was discovered in the Chemung rocks of Taney county.

SPIRIFER MEEKII, n. sp.

Shell small, gibbous, subangular. Ventral valve convex, regularly arched; mesial sinus well defined, narrow, simple near the beak, but marked with three plications on the anterior portions; beak prominent, pointed and strongly incurved; area subtriangular, arched; foramen narrow, triangular. Dorsal valve regularly convex; mesial fold well defined, narrow, depressed, marked with a distinct, impressed line along the middle; beak small, incurved over the cardinal line; hinge line as long or longer than the width of the shell. Surface marked with from ten to twelve simple rounded plications on each side of the mesial fold and sinus; shell punctate.

Length, .58; breadth, .66; thickness, .39.

In the Encrinital Limestone of Pettis, Saline and other counties in Missouri.

SPIRIFER LINEATOIDES, n. sp.

Shell large, gibbous, and transversely elliptical. Ventral valve most convex near the beak, regularly arched to the anterior and lateral margins, abruptly rounded to the cardinal line; beak prominent, strongly incurved; area small; mesial sinus obsolete, or butslightly impressed. Dorsal valve regularly convex; mesial fold broad, rounded, but slightly elevated. Surface marked with numerous distinct, punctate, and granuliferous concentric bands.

Length, 1.88; breadth, 2.51; thickness, 1.21.

Very rare in the Encrinital Limestone of Missouri.

SPIRIFER LITTONI, n. sp.

Shell below the medium size, oblique, gibbous, usually longer than broad. Ventral valve gibbous, most convex towards the beak, regularly curved toward the anterior border, but more abruptly so towards the lateral margins and beak; sinus well defined but shallow, usually much prolonged into the fold of the opposite valve, and marked by one depressed plication in the middle, and one obsolete fold on each side, which is most distinct on the anterior portion; beak large, pointed, prominent and strongly incurved over the apex of the foramen; area rather high, arched and triangular; the base on the hinge line longer than the sides and shorter than the width of the shell; foramen large, triangular, higher than wide. Dorsal valve transversely elliptical, gibbous, somewhat flattened towards the cardinal extremities; lateral edges rounded in to the extremities of the cardinal line; beak prominent and incurved over the hinge line; mesial fold well defined, more or less raised and convex, marked with a depressed line along the middle; some specimens have one obsolete line on each side, giving the fold the appearance of having two depressed plications on each side. Surface marked with from eight to ten simple rounded plications on each side of the mesial fold and sinus, and with numerous concentric fine imbricating lamellæ.

This shell resembles *Sp. Boonensis*, but differs in the forms and markings of the mesial sinus and fold, and in the length of the cardinal line.

Length, .82; breadth, .83; thickness, .61.

Common in the St. Louis Limestone of St. Louis county.

SPIRIFER BOONENSIS, n. sp.

Shell below the medium size, gibbous, oblique, subellipsoidal. Ventral valve very convex, strongly curved longitudinally, curvature increasing towards the beak, abruptly rounded towards the sides and area; mesial sinus well defined, broad and deep towards the anterior margin in adult specimens, much prolonged into the mesial fold of the opposite valve, one fold in the middle becoming obsolete near the beak; on each side of the central plication are two or three others formed by successive subdivisions of the larger plications bounding the sinus on each side; beak much elevated, abruptly incurved over the apex of the foramen; area high, subtriangular, strongly concave, as long as the hinge line; foramen large, higher than wide; hinge line variable, longer, shorter or equal to the greatest width of the shell. Dorsal valve less convex; mesial fold prominent and well defined, marked by one central plication near the beak, which is separated into five or seven by successive subdivisions; beak incurved over the hinge line. Surface marked with about twelve simple rounded plications on each side of the mesial sinus, and about ten on each side of the mesial fold; and with fine concentric imbricating lamellæ.

This fossil resembles the *S. opimus* of Prof. Hall, but differs in the form of the area, the greater number and arrangement of the plications on the mesial fold and sinus, and the much greater number on the sides, and I find no signs of longitudinal striæ. The number and arrangement of the plications, as described above, are constant and unchangeable in all the numerous specimens examined.

Lower Coal Measures of Boone, Randolph and Monroe counties, Mo.

SPIRIFER (CYRTIA?) HANNIBALENSIS, n. sp.

Shell large, very short, broad, thick and angular. Ventral valve high at the beak, whence it descends abruptly to the anterior and lateral margins in lines scarcely arched; sinus deep, and very much prolonged into the fold of the opposite valve; its bottom descends in a straight line from the beak to the extreme anterior margin; beak small, pointed, and straight; area high, flat, triangular, striated longitudinally and transversely; foramen large. Dorsal valve nearly as large as the ventral; very strongly curved from the hinge line to the anterior margin; beak small; mesial fold distinct, elevated and flattened along the center; cardinal line long, straight, salient. Surface marked on each side of the mesial fold and sinus with from fifteen to twenty broad, depressed plications; the whole surface ornamented with fine longitudinal striæ and by small concentric striæ and imbricating lamellæ.

Length, 1.90; breadth, 3.10; thickness, 1.27.

This beautiful species is rare in the Lithographic Limestone of Marion county.

CYRTIA MISSOURIENSIS, n. sp.

Shell small, angular, beak and cardinal extremities salient. Ventral valve very prominent, regularly arched from the beak to the front and anterior portions of the lateral margins; beak pointed and incurved; sinus well defined, becoming deep and broad in front where it projects into the fold of the dorsal valve; area somewhat regularly concave, triangular; the hinge line but little longer than the sides, and about equal to the greatest width of the shell; foramen rather large, widening regularly from the beak to the hinge line, closed by a convex pseudo-deltidium, which is perforated above the middle. Dorsal valve semi-elliptical, convex, flattened towards the cardinal extremities, which are somewhat produced; mesial fold convex, well defined and bounded by grooves larger and deeper than those separating the plication; beak incurved against the lower extremity of the deltidium. Surface marked with rounded plications, seven to nine on each side of the mesial fold, and eight to ten on each side of the mesial sinus. There is also one plication, somewhat smaller than the others, on each slope of the mesial fold and sinus. The plications bounding the mesial sinus are larger than the others; the internal casts of the shell show all the plications less distinctly. The shell is also marked with fine imbricating concentric lamellæ and numerous small punctures.

This species is more nearly allied to the *Cyrtia umbonata* of Prof. Hall than to any other. It differs however from that in having plications on the mesial fold and in the sinus of the ventral valve; the plications are more numerous and extend to the beak; the foramen is wider at the base.

Found in the Hamilton Group of Callaway county, Mo., where it appears to be confined to a stratum of bluish brown limestone not more than six inches thick. In that stratum it is very abundant, and, so far as observed, is accompanied by but two other species, the *Atrypa reticularis* and *Spirigera Fultonensis.*

CYRTIA OCCIDENTALIS, n. sp.

Shell of medium size, semi-conical. Ventral valve high, semi-conical, slightly curved from the beak to the anterior and lateral margins; sinus well defined, very wide and flattened in front; area slightly concave, high and triangular—base but little longer than the slightly curved sides; foramen extending from the beak to the cardinal line, much wider at the base, and not closed in the specimens observed; beak pointed and slightly incurved; dorsal valve convex, somewhat quadrangular, much broader than long; lateral edges rounded towards the cardinal extremities; mesial fold broad and convex in front; cardinal line shorter than the greatest width of the shell. Surface marked with some fifteen or twenty rounded plications on each side of the mesial fold and sinus, and numerous concentric lamellose lines, which often become very conspicuous towards the margins; shell punctate.

This species somewhat resembles the *Spirifer aspera* of Prof. Hall; but the mesial fold and the sinus are much wider in front, the cardinal extremities much less salient, the area higher and the shell punctate.

Very rare in the Hamilton Group of Callaway county, Mo., associated with *Atrypa reticularis* and *Strophodonta demissa.*

SPIRIGERA MINIMA, n. sp.

Shell minute, varying from ovate to orbicular, depressed. Ventral valve rather convex, slightly flattened towards the margins; beak small, incurved; perforation circular, small; mesial sinus broad and subangular. Dorsal valve less convex, highest near the beak; beak small, curved beneath the perforation of the opposite beak; mesial fold broad and but slightly elevated. Surface marked with numerous very thin concentric lamellæ, which stand out nearly perpendicular to the surface of the shell; structure punctate; spiral appendage very large.

Length, .28; breadth, .28; thickness, .15.

This beautiful little species is very rare in the Hamilton rocks of Callaway county.

SPIRIGERA PROUTII, n. sp.

Shell gibbous, transversely elliptical, thickened on the cardinal border, giving the appearance of a curved linear area. Ventral valve very convex, highest near the beak, whence it is strongly arched to the anterior and lateral margins, and very abruptly to the cardinal; beak prominent, incurved, and perforated with a circular opening; sinus large, deep, and defined by an elevated, rounded ridge on each side—its anterior extremity is prolonged far into the fold of the opposite valve. Dorsal valve very convex, highest in the middle, strongly arched to the anterior margin on each side of the mesial fold, which is well defined in front and obsolete towards the beak. Surface marked with concentric bands and ornamented with fine concentric and longitudinal striæ, which give the shell a fine granulated appearance.

Length, .66; breadth, .71; thickness, .45.

From the Chemung rocks of St. Louis county, near the Sulphur Springs.

SPIRIGERA HANNIBALENSIS, n. sp.

Shell lenticular, varying from suborbicular to transversely elliptical; marked with broad imbricating lamellæ. Ventral valve convex, highest near the beak and somewhat flattened near the margins; beak small; perforation circular, usually partly closed by the beak of the opposite valve; sinus most distinct in front, regularly arched. Dorsal valve more convex and regularly arched: flattened near the cardinal extremities; beak small, incurved beneath the beak of the opposite valve; mesial fold less distinct than the sinus. Sur-

SPIRIFER LITTONI, n. sp.

Shell below the medium size, oblique, gibbous, usually longer than broad. Ventral valve gibbous, most convex towards the beak, regularly curved toward the anterior border, but more abruptly so towards the lateral margins and beak; sinus well defined but shallow, usually much prolonged into the fold of the opposite valve, and marked by one depressed plication in the middle, and one obsolete fold on each side, which is most distinct on the anterior portion; beak large, pointed, prominent and strongly incurved over the apex of the foramen; area rather high, arched and triangular; the base on the hinge line longer than the sides and shorter than the width of the shell; foramen large, triangular, higher than wide. Dorsal valve transversely elliptical, gibbous, somewhat flattened towards the cardinal extremities; lateral edges rounded in to the extremities of the cardinal line; beak prominent and incurved over the hinge line; mesial fold well defined, more or less raised and convex, marked with a depressed line along the middle; some specimens have one obsolete line on each side, giving the fold the appearance of having two depressed plications on each side. Surface marked with from eight to ten simple rounded plications on each side of the mesial fold and sinus, and with numerous concentric fine imbricating lamellæ.

This shell resembles *Sp. Boonensis*, but differs in the forms and markings of the mesial sinus and fold, and in the length of the cardinal line.

Length, .82; breadth, .83; thickness, .61.

Common in the St. Louis Limestone of St. Louis county.

SPIRIFER BOONENSIS, n. sp.

Shell below the medium size, gibbous, oblique, subellipsoidal. Ventral valve very convex, strongly curved longitudinally, curvature increasing towards the beak, abruptly rounded towards the sides and area; mesial sinus well defined, broad and deep towards the anterior margin in adult specimens, much prolonged into the mesial fold of the opposite valve, one fold in the middle becoming obsolete near the beak; on each side of the central plication are two or three others formed by successive subdivisions of the larger plications bounding the sinus on each side; beak much elevated, abruptly incurved over the apex of the foramen; area high, subtriangular, strongly concave, as long as the hinge line; foramen large, higher than wide; hinge line variable, longer, shorter or equal to the greatest width of the shell. Dorsal valve less convex; mesial fold prominent and well defined, marked by one central plication near the beak, which is separated into five or seven by successive subdivisions; beak in-

Spirigera Maconensis, n. sp.

Shell small, gibbous, varying from ovate to orbicular. Ventral valve rather convex, most elevated near the beak, whence it is regularly arched to the margins; beak large, incurved; perforation orbicular or subovate; mesial sinus well defined in front, but usually obsolete towards the beak. Dorsal valve somewhat smaller, sub-orbicular, most convex near the beak, slightly flattened towards the lateral margins; convex along the middle, with a slight mesial sinus on the anterior portion of adult shells; beak curved beneath and usually breaking into the perforation of the opposite beak. Surface marked with numerous unequal, subimbricating, concentric plications.

Large orbicular specimen—Length, .50; breadth, .50; thickness, .30.

Large ovate specimen—Length, .55; breadth, .48; thickness, .35.

Common in the Coal Measures of Montgomery county.

Spirigera Charitonensis, n. sp.

Shell orbicular, lenticular; valves regularly and about equally convex; beaks small. Ventral valve very regularly convex; slightly most prominent near the beak; mesial sinus slightly depressed and subangular in front; obsolete near the beak; in adult specimens the anterior portion is extended in a linguiform process into a corresponding elevation of the opposite valve; beak small, perforated; the circular aperture partially closed by the beak of the opposite valve. Dorsal valve slightly elongated transversely, regularly convex; slightly raised along the center into an obsolete mesial fold, which becomes more elevated and rounded in front in adult specimens, which usually have a depressed line along the center of the mesial fold on the anterior half of the shell; beak small, incurved beneath the opposite beak. Surface marked with numerous concentric imbricating folds, which become lamellose and conspicuous near the border of adult specimens. It is also ornamented by numerous fine concentric striæ. Structure punctate.

Length, 1.10; breadth, 1.10; thickness, .70.

This fossil most resembles the *Athyris* (*Spirigera?*) *differentius* of Mr. McChesney, but it is more orbicular and regularly lenticular, and the mesial sinus is much less developed, especially towards the beak.

Rare in the Coal Measures of Chariton and Randolph counties.

Spirigera Jacksoni, n. sp.

Shell rather large, elongate, ovate, striate, punctate; broad wards the cardinal extremities, which are somewhat produced; mesial fold convex, well defined and bounded by grooves larger and deeper than those separating the plication; beak incurved against the lower extremity of the deltidium. Surface marked with rounded plications, seven to nine on each side of the mesial fold, and eight to ten on each side of the mesial sinus. There is also one plication, somewhat smaller than the others, on each slope of the mesial fold and sinus. The plications bounding the mesial sinus are larger than the others; the internal casts of the shell show all the plications less distinctly. The shell is also marked with fine imbricating concentric lamellæ and numerous small punctures.

This species is more nearly allied to the *Cyrtia umbonata* of Prof. Hall than to any other. It differs however from that in having plications on the mesial fold and in the sinus of the ventral valve; the plications are more numerous and extend to the beak; the foramen is wider at the base.

Found in the Hamilton Group of Callaway county, Mo., where it appears to be confined to a stratum of bluish brown limestone not more than six inches thick. In that stratum it is very abundant, and, so far as observed, is accompanied by but two other species, the *Atrypa reticularis* and *Spirigera Fultonensis*.

CYRTIA OCCIDENTALIS, n. sp.

Shell of medium size, semi-conical. Ventral valve high, semi-conical, slightly curved from the beak to the anterior and lateral margins; sinus well defined, very wide and flattened in front; area slightly concave, high and triangular—base but little longer than the slightly curved sides; foramen extending from the beak to the cardinal line, much wider at the base, and not closed in the specimens observed; beak pointed and slightly incurved; dorsal valve convex, somewhat quadrangular, much broader than long; lateral edges rounded towards the cardinal extremities; mesial fold broad and convex in front; cardinal line shorter than the greatest width of the shell. Surface marked with some fifteen or twenty rounded plications on each side of the mesial fold and sinus, and numerous concentric lamellose lines, which often become very conspicuous towards the margins; shell punctate.

This species somewhat resembles the *Spirifer aspera* of Prof. Hall; but the mesial fold and the sinus are much wider in front, the cardinal extremities much less salient, the area higher and the shell punctate.

Very rare in the Hamilton Group of Callaway county, Mo., on the anterior portion; beak long, pointed, incurved; foramen large, triangular. Dorsal valve not known.

Length, .75; breadth, .61.

This shell differs from *P. galeatus* in being much more elongated; in having a longer and more pointed beak, and in having a higher and larger foramen.

Rare in the Devonian rocks at the base of the Chemung Group in Moniteau county.

RHYNCHONELLA WARRENENSIS, n. sp.

Shell small, depressed, orbiculo-cuneate, wider than long. Ventral valve convex, flattened towards the lateral margins, depressed in front; beak long, pointed, moderately incurved, and projecting beyond the beak of the opposite valve; mesial sinus broad and shallow on the anterior half of the shell; not developed on the posterior part towards the beak; margins rounded in front; more abruptly curved on the lateral margins; cuneate towards the beak. Dorsal valve regularly convex, raised in front; beak small, incurved beneath the beak of the opposite valve. Surface marked by about twenty-three rounded, radiating plications; about three in the mesial sinus and as many on the opposite fold; whole finely punctate.

Length, .40; breadth, .45; thickness, .20.

Rare in the Lower Devonian rocks of Callaway county.

RHYNCHONELLA RINGENS, n. sp.

Shell large, thick, triangular, plicated, truncated and flattened in front. Ventral valve flattened, triangular; the anterior and the posterior lateral margins abruptly turned up to meet the dorsal valve; the anterior lateral margins curved down in the opposite direction; beak acuminate; sinus wide and shallow, containing about eight plications. Dorsal valve more convex; anterior and posterior lateral margins abruptly turned down to meet the opposite valve; strongly arched towards the anterior lateral margins. The junction of the valves is sharply and deeply serrated. Surface marked with about fourteen large plications on each valve.

Length, 1.90; breadth, 1.43; thickness, .99.

This species was discovered in the chert beds of the Encrinital Limestone of Callaway county, by Prof. Kemper.

RETZIA OSAGENSIS, n. sp.

Shell rather large, ovate, gibbous, costate. Ventral valve very convex, highest near the beak, regularly arched from the beak to the anterior margin, somewhat flattened in front; beak large, elongate, perforated; perforation oblique, circular; anterior margin rounded. Dorsal valve smaller, mo convex along the middle, subflattened towards the later margins, highest near the beak; beak large, pointed, incur ed beneath and in contact with the opposite beak. Surfac marked with numerous small, depressed, radiating costæ, an by fine concentric striæ and a few distinct lines of growth.

Length, 1.22; breadth, .95; thickness, .75.

This fossil has been confounded with *Terebratula* (*Retzia Marcyi* of Dr. Shumard, but it is very distinct. It is muc larger, its costæ are much more numerous, and it has concer tric striæ. It also has the general appearance of *R. vera* c Prof. Hall; but it has much finer costæ, is more gibbous, an not so wide in front. It also resembles some varieties c *hastata* of Sowerby, but its markings will always distinguis it from that species.

Very rare in the Chemung rocks of Cooper and Bento counties.

RETZIA (?) POPEANA, n. sp.

Shell elongate, subovate, widest near the middle, rounde in front, subcuneate towards the beaks; gibbous near th beaks, but much flattened towards the front and lateral mar gins, where the valves form a sharp, thin edge. Ventral valv larger, more convex; beak large, elongate, incurved; forame oblique, round; area small, triangular; cardinal margin thickened. Dorsal valve convex towards the beak and flat tened towards the lateral and anterior margins; beak rathe large, cuspidate, slightly incurved. Surface finely punctate punctures arranged in regular concentric lines and in less re gular longitudinal rows. The cast is usually marked wit unequal, obsolete, longitudinal costæ.

Length, .1; breadth, .71; thickness, .42.

This fossil may be distinguished from *R. Osagensis* by want of costæ. It resembles *R. fusiformis* of M. Verneui with which it has been confounded, but it is very distinct I is thickest near the beaks, and is much more compressed i form than the specimens of the European shell before me.

ACEPHALA.

EDMONDIA MARIONENSIS, n. sp.

Shell large, gibbous, sub-quadrangular. Valves very con vex; flattened or concave towards the posterior cardinal bor der; abruptly arched to near the anterior cardinal margin and then recurved, giving a sharp, thin edge; regularly arche to the ventral margin; ventral margin regularly arched; an terior and posterior margins arched and inclined towards th beaks; umbones large and convex; beaks contiguous neare the anterior extremity. Surface marked with fine concentric striæ and obsolete plications.

Length, 1.95; height, 1.41; thickness, 1.31.

Rare in the Chouteau Limestone of Cooper county.

CARDIOMORPHA (?) TRIANGULATA, n. sp.

Shell small, sub-triangular. Valves narrow and sharply rounded at the anterior extremity; wider at the posterior end; flattened towards the ventral margin, which is slightly arched; umbones depressed; beaks small, strongly incurved, contiguous, nearer the anterior extremity; area long, narrow, longitudinally striate; areola concave, lanceolate; somewhat rounded ridges extend from the beaks to the posterior ventral margin. Surface marked with numerous, unequal, concentric, subangular, plications and by fine concentric striæ.

Length, 1.04; height, .79; thickness, .41.

Also found in the Chouteau Limestone of Cooper county, associated with *Cardinia occidentalis*, *Goniatites Holmesii*, *G. Osagensis*, *Spirifer Missouriensis*, and *Sp. Cooperensis*.

CARDINIA OCCIDENTALIS, n. sp.

Shell gibbous, subovate, plicate. Valves very convex, subflattened towards the posterior cardinal border; anterior extremity wide and regularly rounded; ventral margin convex, most abruptly arched towards the posterior margin; posterior extremity narrower and more sharply rounded; umbones large and convex; beaks large, strongly incurved, contiguous, near the anterior extremity; profile concave from the beaks to the anterior cardinal border, straight from the beaks to the posterior cardinal border. Surface marked by numerous large, subangular, unequal, concentric plications.

Length, 1.19; height, .88; thickness, .63.

This fossil is abundant in the Chouteau Limestone of Cooper, Saline, and Moniteau counties.

Var. *minor* is much smaller, and more orbicular. It is found in the same rocks, and is probably a distinct species; but I have thought it best to place it in this connection till more perfect specimens are obtained for accurate comparison.

SOLEN (?) MISSOURIENSIS, n. sp.

Shell, large, elongate, compressed and widest towards the posterior extremity, with an angular ridge from the umbo to the angle of the posterior and ventral margins; flattened or concave on the posterior cardinal slopes, and slightly convex towards the ventral margin. Posterior margin straight, oblique; ventral margin slightly and regularly convex; cardinal border nearly straight back of the beaks; anterior extremity narrow and rounded. Surface marked by strong pliand rounded in front. Ventral valve very convex, strongly arched longitudinally; umbo large; beak large, strongly incurved; perforation subovate; mesial sinus wanting or rarely obsolete. Dorsal valve less convex, most prominent near the beak, ovate, flattened in front; umbo large; beak short, incurved beneath and cutting into the periphery of the perforation of the opposite beak; mesial fold wanting. Surface marked with numerous concentric lines of growth, which become very distinct and sublamellose near the margin. It is also ornamented with very fine concentric and radiating striæ.

Length, 1.32; breadth, 1.02; thickness, .63.

This fossil was discovered by Dr. Norwood, in the Upper Coal Measures of Cass county.

Spirigera Hawnii, n. sp.

Shell very gibbous, elongate, nearly as thick as wide, ellipsoidal, striate. Ventral valve regularly arched from the beak to the anterior margin, which is very much prolonged into the fold of the opposite valve; curved abruptly towards the lateral margins; mesial sinus broad and subcarinate in front, but obsolete towards the beak; bounded by ridges which terminate at the base of the large linguiform process in front; beak large, strongly incurved; perforation small, circular. Dorsal valve about as large and convex as the ventral; most prominent near the beak, whence it is nearly straight along the mesial fold to the anterior margin; mesial fold much elevated and rounded in front, presenting a well defined sinus on each side of the anterior portion—these sinuses correspond to the ridges bounding the sinus of the ventral valve; beak strongly incurved beneath the beak of the opposite valve. Surface marked by numerous concentric folds and fine concentric and still finer longitudinal striæ; when partly exfoliated, it exhibits small longitudinal costæ; the whole punctate.

Length, .84; width, .76; thickness, .55.

Length, .90; width, .73; thickness, .82.

This fossil is most like *Sp. subtilita* of Prof. Hall, but it is more gibbous, more elliptical and has the fine striations different from that species.

Coal Measures of the State of Missouri.

Pentamerus Salinensis, n. sp.

Shell small, ovate, plicate, with a long pointed beak on the ventral valve. Ventral valve gibbous, highest near the beak; gradually arched towards the anterior margin, but much more abruptly towards the lateral and cardinal borders; flattened in front and marked with nine or ten depressed plications on the anterior portion; beak long, pointed, incurved; foramen large, triangular. Dorsal valve not known.

Length, .75; breadth, .61.

This shell differs from *P. galeatus* in being much more elongated; in having a longer and more pointed beak, and in having a higher and larger foramen.

Rare in the Devonian rocks at the base of the Chemung Group in Moniteau county.

RHYNCHONELLA WARRENENSIS, n. sp.

Shell small, depressed, orbiculo-cuneate, wider than long. Ventral valve convex, flattened towards the lateral margins, depressed in front; beak long, pointed, moderately incurved, and projecting beyond the beak of the opposite valve; mesial sinus broad and shallow on the anterior half of the shell; not developed on the posterior part towards the beak; margins rounded in front; more abruptly curved on the lateral margins; cuneate towards the beak. Dorsal valve regularly convex, raised in front; beak small, incurved beneath the beak of the opposite valve. Surface marked by about twenty-three rounded, radiating plications; about three in the mesial sinus and as many on the opposite fold; whole finely punctate.

Length, .40; breadth, .45; thickness, .20.

Rare in the Lower Devonian rocks of Callaway county.

RHYNCHONELLA RINGENS, n. sp.

Shell large, thick, triangular, plicated, truncated and flattened in front. Ventral valve flattened, triangular; the anterior and the posterior lateral margins abruptly turned up to meet the dorsal valve; the anterior lateral margins curved down in the opposite direction; beak acuminate; sinus wide and shallow, containing about eight plications. Dorsal valve more convex; anterior and posterior lateral margins abruptly turned down to meet the opposite valve; strongly arched towards the anterior lateral margins. The junction of the valves is sharply and deeply serrated. Surface marked with about fourteen large plications on each valve.

Length, 1.90; breadth, 1.43; thickness, .99.

This species was discovered in the chert beds of the Encrinital Limestone of Callaway county, by Prof. Kemper.

RETZIA OSAGENSIS, n. sp.

Shell rather large, ovate, gibbous, costate. Ventral valve very convex, highest near the beak, regularly arched from the beak to the anterior margin, somewhat flattened in front; beak large, elongate, perforated; perforation oblique, circular; anterior margin rounded. Dorsal valve smaller, most convex along the middle, subflattened towards the lateral margins, highest near the beak; beak large, pointed, incurved beneath and in contact with the opposite beak. Surface marked with numerous small, depressed, radiating costæ, and by fine concentric striæ and a few distinct lines of growth.

Length, 1.22; breadth, .95; thickness, .75.

This fossil has been confounded with *Terebratula* (*Retzia*) *Marcyi* of Dr. Shumard, but it is very distinct. It is much larger, its costæ are much more numerous, and it has concentric striæ. It also has the general appearance of *R. vera* of Prof. Hall; but it has much finer costæ, is more gibbous, and not so wide in front. It also resembles some varieties of *hastata* of Sowerby, but its markings will always distinguish it from that species.

Very rare in the Chemung rocks of Cooper and Benton counties.

Retzia (?) Popeana, n. sp.

Shell elongate, subovate, widest near the middle, rounded in front, subcuneate towards the beaks; gibbous near the beaks, but much flattened towards the front and lateral margins, where the valves form a sharp, thin edge. Ventral valve larger, more convex; beak large, elongate, incurved; foramen oblique, round; area small, triangular; cardinal margins thickened. Dorsal valve convex towards the beak and flattened towards the lateral and anterior margins; beak rather large, cuspidate, slightly incurved. Surface finely punctate; punctures arranged in regular concentric lines and in less regular longitudinal rows. The cast is usually marked with unequal, obsolete, longitudinal costæ.

Length, .1; breadth, .71; thickness, .42.

This fossil may be distinguished from *R. Osagensis* by a want of costæ. It resembles *R. fusiformis* of M. Verneuil, with which it has been confounded, but it is very distinct It is thickest near the beaks, and is much more compressed in form than the specimens of the European shell before me.

ACEPHALA.

Edmondia Marionensis, n. sp.

Shell large, gibbous, sub-quadrangular. Valves very convex; flattened or concave towards the posterior cardinal border; abruptly arched to near the anterior cardinal margin, and then recurved, giving a sharp, thin edge; regularly arched to the ventral margin; ventral margin regularly arched; anterior and posterior margins arched and inclined towards the beaks; umbones large and convex; beaks contiguous nearer the anterior extremity. Surface marked with fine concentric striæ and obsolete plications.

Length, 1.95; height, 1.41; thickness, 1.31.

Rare in the Chouteau Limestone of Cooper county.

CARDIOMORPHA (?) TRIANGULATA, n. sp.

Shell small, sub-triangular. Valves narrow and sharply rounded at the anterior extremity; wider at the posterior end; flattened towards the ventral margin, which is slightly arched; umbones depressed; beaks small, strongly incurved, contiguous, nearer the anterior extremity; area long, narrow, longitudinally striate; areola concave, lanceolate; somewhat rounded ridges extend from the beaks to the posterior ventral margin. Surface marked with numerous, unequal, concentric, subangular, plications and by fine concentric striæ.

Length, 1.04; height, .79; thickness, .41.

Also found in the Chouteau Limestone of Cooper county, associated with *Cardinia occidentalis*, *Goniatites Holmesii*, *G. Osagensis*, *Spirifer Missouriensis*, and *Sp. Cooperensis*.

CARDINIA OCCIDENTALIS, n. sp.

Shell gibbous, subovate, plicate. Valves very convex, subflattened towards the posterior cardinal border; anterior extremity wide and regularly rounded; ventral margin convex, most abruptly arched towards the posterior margin; posterior extremity narrower and more sharply rounded; umbones large and convex; beaks large, strongly incurved, contiguous, near the anterior extremity; profile concave from the beaks to the anterior cardinal border, straight from the beaks to the posterior cardinal border. Surface marked by numerous large, subangular, unequal, concentric plications.

Length, 1.19; height, .88; thickness, .63.

This fossil is abundant in the Chouteau Limestone of Cooper, Saline, and Moniteau counties.

Var. *minor* is much smaller, and more orbicular. It is found in the same rocks, and is probably a distinct species; but I have thought it best to place it in this connection till more perfect specimens are obtained for accurate comparison.

SOLEN (?) MISSOURIENSIS, n. sp.

Shell, large, elongate, compressed and widest towards the posterior extremity, with an angular ridge from the umbo to the angle of the posterior and ventral margins; flattened or concave on the posterior cardinal slopes, and slightly convex towards the ventral margin. Posterior margin straight, oblique; ventral margin slightly and regularly convex; cardinal border nearly straight back of the beaks; anterior extremity narrow and rounded. Surface marked by strong plications and fine striæ parallel to the ventral, posterior and anterior margins, and by plications radiating from the beaks, which are soon interrupted, and wholly disappear before they reach the middle of the shell, giving the anterior cardinal portion of the shell a tuberculated appearance.

Length, 5.35; height, 1.51; thickness, .82.

This rare fossil was discovered by Mr. Broadhead in Pike county.

Allorisma ensiformis, n. sp.

Shell large, recurved, subcylindrical, but flattened, tapered and rounded towards the posterior extremity. Valves are convex in the middle and towards the anterior extremity, flattened toward the posterior; anterior margin oblique and convex; ventral margin convex, curve increasing towards the posterior extremity; cardinal margin concave; area striated longitudinally; umbones large, prominent. Surface marked with broad folds and fine striæ, parallel to the ventral margin.

Length, 4.41; height, 1.69; thickness, 1.39.

From the limestones of the Coal Measures in Clay county.

Pecten Hallii, n. sp.

Shell small, ovate, coarsely plicate. Left valve convex; raised portion cuneate towards the beak, marked with about sixteen high, rounded, radiating ribs, (which are increased by implantation near the beak) and by fine concentric striæ and very distinct lines of growth; anterior wing very distinct, triangular, marked with striæ parallel to the anterior margin; posterior wing longer, more acuminate, marked with strong striæ parallel to the posterior margin; sinus on the posterior margin deep, broad, and more abruptly curved towards the cardinal border; beak small, depressed.

Length, .46; height, .44; length of posterior wing, .22; length of anterior wing, .10.

This fossil resembles the *Pecten occidentalis* of Dr. Shumard, but it is longer in proportion; it has fewer ribs, which are not increased by bifurcation as in that species.

It was discovered by Maj. Hawn in the Coal rocks at Willow Springs, K. T.

GASTEROPODA.

Conularia Marionensis, n. sp.

Shell pyramidal, quadrilateral. Base rhombic; obtuse lateral edges deeply sulcate; sides marked with two sets of high, granulated, transverse costæ; they commence on the margins and curve towards the base, then partially back and meet or intersect in the middle, forming an obsolete mesial line where the two sets meet; the spaces between the costæ twice as wide as the costæ. There are twenty costæ in a space equal to the width of the side, at the place counted. The sulcations are marked with obsolete, irregular striæ.

This species has the general appearance of the *C. Missouriensis*, but may be easily distinguished by the granulations of the costæ and by the greater number of costæ.

Very rare in the Upper Hamilton Shales at Hannibal and other places in Marion county.

Conularia triplicata, n. sp.

Shell very small, pyramidal and quadrilateral. Base rhombic; obtuse lateral edges marked with a deep, broad sulcation; sides marked with high, granular, transverse costæ; costæ arched, the convexity towards the apex of the shell; they are triplicate, composed of one high central ridge in the middle and one lower on each side, all granulated. There are eight triplicate costæ in a space equal to the width of the side where counted.

This beautiful little fossil may be distinguished from all others by its peculiar markings.

Associated with *C. Marionensis* in the Upper Hamilton Shales in Marion county.

Conularia Missouriensis, n. sp.

Shell large, in the form of an elongated four-sided pyramid with a depressed rhombic base. The obtuse lateral edges are marked by deep angular sulcations; the acute lateral edges subcarinated. Surface polished; each of the four sides marked by flexuous, high, sharp plications. There are two sets of plications on each side; they commence on the sides and curve towards the base, then partially back, when they meet or intersect in the middle, forming an indistinct longitudinal sulcation along the middle of each side; the space between the plications is at least twice as wide as the plications. There are ten plications in a space equal to the width of the side where they are situated.

From the Carboniferous Limestone of Cooper county.

Trochus Missouriensis, n. sp.

Shell very large, obliquely conico-pyramidal; surface highly polished and beautifully cancellated; base broad, concave; whorls about eight, carinated above and below; lower and outer surfaces flattened, scarcely convex, meeting at an acute angle; upper surface slightly concave to fit the under surface of the whorl above, and forms with the outer surface an obtuse angle; the lower edge of each whorl projects a little beyond the upper edge of the whorl below; the lower and outer surfaces are ornamented with numerous unequal revolving striæ, crossed by transverse striæ oblique, and parallel to the margins of the aperture; those on the lower surface more or less sigmoid; aperture oblique, subrhomboidal.

Height, 3.25; width of base, 3.85.

This rare species is perhaps the largest known *Trochus*. It still retains its pristine luster and gracefully cancellated surface. It very much resembles *T. marmoratus*, Lam., of the present seas; but it has fewer whorls, a broader and more concave base, finer and more delicate markings.

The magnificent specimen before me was discovered by Col. Wm. Gilpin in the Coal Measures of Jackson county, and was presented to Dr. Norwood for the State Collection.

Littorina Wheeleri, n. sp.

Shell small, subglobose, granulated. Spire short, depressed; whorls three, convex; the last large and inflated; suture impressed; aperture slightly oblique, oval; surface covered with small semiglobular granules, each of which has a slight depression in its summit.

Length, .27; breadth, .23; length of aperture, .19; breadth of aperture, .14.

This unique little shell was discovered by Mr. Broadhead, in the Coal Measures of Monroe county.

CEPHALOPODA.

Nautilus Lawsii, n. sp.

Shell very large; septa very numerous and very convex; volutions depressed on the dorsal surface, somewhat flattened on the sides, and flattened or concave on the inner surface; taper gradual; aperture elliptical.

Diameter of the shell, 10.75 inches; length of aperture, 4 inches; width, 3.25.

This large and very rare fossil was discovered by President Laws of Westminster College, in the lower beds of the Hamilton rocks of Callaway county, where it is associated with *Strophodonta cymbiformis*, *S. navalis*, *S. Kemperi*, *S. inflexa*, and *Spirifer amarus*.

Nautilus Gilpini, n. sp.

Shell very large, flattened on the outer margin; whorls rapidly increasing; last chamber very large. Whorls few, much flattened on the outer margin; sharply rounded on the sides; the last is very large and nearly conceals the others;

umbilicus large, deep, cylindrical within, expanding rapidly outward; aperture wide and short, much modified by the preceding whorl; has a broad sinus in front; septa very convex, arched on the outer margin and nearly straight on the sides. The cast shows longitudinal striæ on the center of the outer margin of the whorls.

Width of aperture, 3.21; length of aperture, 2.05.

This fine Nautilus was presented to the Geological Survey by Col. Wm. Gilpin, who obtained it at Wayne City in the Coal Measures.

GONIATITES OSAGENSIS, n. sp.

Shell small, discoid, moderately convex, having internal, transverse strengthening ridges, which vary from four to six in the outer whorl, as indicated by the constrictions on the cast; umbilicus small, deep, slightly infundibuliform; septa form a broad, shallow, forward curve on the sides, and a more abrupt backward sinus on the dorsal margin; constrictions slightly curved; aperture large, 0.25 long and 0.30 wide; diameter of the shell, 0.88; whorls rounded on the dorsal margin, flattened on the sides.

This beautiful little species resembles *G. micronatus* of Phillips (Geol. York., Pl. XIX., p. 234), but is easily distinguished by the septa.

Abundant in the Chemung rocks of Cooper and Moniteau counties.

GONIATITES (?) HOLMESII, n. sp.

Shell flattened, discoid, sharply rounded on the dorsal margin; umbilicus rather small infundibuliform; whorls decreasing rapidly; aperture elongate; a rounded sinus in front; septa not seen; no constrictions on the cast.

Diameter of shell, 1.02; thickness, .30; length of aperture, .54; width of aperture, .38.

This fossil is less convex with a greater diameter than *G. Osagensis* above described.

Rare in the Chemung rocks of Cooper county; casts only have been obtained.

GONIATITES MORGANENSIS, n. sp.

Shell very small, gibbous, subdiscoidal, broadly rounded on the dorsal margin; umbilicus small, deep, subinfundibuliform; whorls tapering moderately, regularly rounded from the umbilicus to the dorsal margin; constrictions three or four deep and broad, scarcely flexuous; aperture short and broad; septa not seen; casts only discovered.

Diameter, .38; thickness, 21; length of aperture, .10; width of aperture, .23.

This beautiful little fossil nearly resembles the *G. auris* of the Upper Devonian rocks of the Eifel; but it is more convex, tapers more gradually, has a smaller umbilicus and a shorter aperture.

Very rare in the Chemung rocks of Missouri. The Chouteau Limestone has furnished all the specimens in the State Cabinet.

ORTHOCERAS CHEMUNGENSE, n. sp.

Shell small, tapering moderately; transverse section elliptical; septa very concave; distant nearly half the shorter diameter; siphuncle small, central.

Longest diameter, .64; shorter diameter, .51; distance of septa, .24; diameter of siphuncle, .06.

This fossil is very like *O. ovalis* of Phillips (Geol. York., Vol. II., p. 238); but the siphuncle is more central in our species.

Rare in the Lithographic Limestone of Marion and Pike counties.

The variety *Chouteauense* may always be distinguished by the comparative distance of the septa, which are separated only one-fourth of the lesser diameter.

Abundant in the Chouteau Limestone of Cooper county.

NOTES ON THE GRAPE-VINES OF MISSOURI.

By GEO. ENGELMANN, M.D.

In the Transactions of the Academy (p. 156 of this volume) Prof. Swallow has published an interesting contribution on the adaptation of our State to the cultivation of the grapevine. The article, abounding in valuable information, contains some inaccuracies, which, as the whole subject is so very interesting and important, it may not be improper here to indicate.

The grape-vines proper (gen. *Vitis*, sect. *Vitis*) indigenous to Missouri are *Vitis æstivalis* and *Vitis cordifolia*, with their numberless varieties; popularly speaking, they are distinguished as the *Summer Grape* and the *Winter* or *Frost Grape*, also sometimes called *Fox Grape*. The former grows on uplands in open woods and thickets, is of smaller dimensions, has deeply lobed leaves with rounded sinuses of the lobes, covered when young with a rose-red down, more or less naked above when old, and bears smaller bunches of larger berries, ripening and edible earlier, say in August and September, whence the name.

The winter-grape, *Vitis cordifolia*, grows in richer soil, usually in shady woods, on our river banks and in their bottoms, attaining the greatest dimensions (sometimes 10 inches in thickness and 80 or more feet in height); it has undivided or (with us) usually slightly lobed leaves with sharp sinuses between the lobes, entirely naked even when young or covered with a slight whitish down, and bears smaller berries in larger bunches, ripening and edible not before October or even November. Those that have experimented on them contend that, notwithstanding this, the wine made of this winter-grape is by far superior to that made of the summer grape.

Both these species are extremely variable, and it is quite probable that, being diœcious,* they by hybridization produce intermediate forms, which may become of interest to the cultivator, and may indicate the method by which to produce valuable new varieties.†

These are the principal if not the only species of *Vitis* proper, in our State, and they grow in all its counties as well as throughout the Mississippi valley. They are comprised in Prof. Swallow's enumeration under No. 1 to 4, p. 160–161. His No. 1, *V. Labrusca*, is not the plant which Linnæus has designated by this name and which to eastern botanists is known as such. This, the true *Vitis Labrusca*, is a plant with rusty woolly leaves (naked above when old), bearing very large pulpy berries of a foxy taste, whence the popular name of fox grape in the eastern States. It is found, as far as I am informed, all along the Atlantic slope and up into the Alleghany Mountains, but does not extend into the Mississippi valley. It is considered to be the mother plant of the cultivated Catawba, Isabella, and other American varieties.

Vitis Labrusca of Prof. Swallow must be referred to *V. cordifolia*, when he describes it as a plant growing to very

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* It is an interesting fact that all the true grapes of America (not those belonging to the section *Cissus*), in the wild state, are diœcious or diœco-polygamous, while the cultivated varieties bear complete flowers. The same is the case with the grape-vine of the old world, which still grows wild and to an immense size in the marshy forests of the lower Arno in Tuscany, being called there to this day by the old Latin name, mentioned by Virgil, *Labrusca*, a name which Linnæus has improperly applied to one of the American species.

† It is well known and sufficiently proven by a thousand times repeated experiments, instituted with almost every variety of this plant from all parts of the old world, that the *Vitis vinifera*, the grape-vine of Europe, will not thrive in our climate. Soon losing its leaves under our burning summer sun, it is scarcely able to ripen the few bunches of fruit it may bear, and can not bring its wood to perfection; so that our variable winters almost always kill the vines down to tne ground, if not carefully protected. Would it not be possible by hybridization to produce a grape-vine with the tough and enduring leaves of our native grapes and the luscious and juicy fruit of the better varieties of *Vitis vinifera*?

tuse angle; the lower edge of each whorl projects a little beyond the upper edge of the whorl below; the lower and outer surfaces are ornamented with numerous unequal revolving striæ, crossed by transverse striæ oblique, and parallel to the margins of the aperture; those on the lower surface more or less sigmoid; aperture oblique, subrhomboidal.

Height, 3.25; width of base, 3.85.

This rare species is perhaps the largest known *Trochus*. It still retains its pristine luster and gracefully cancellated surface. It very much resembles *T. marmoratus*, Lam., of the present seas; but it has fewer whorls, a broader and more concave base, finer and more delicate markings.

The magnificent specimen before me was discovered by Col. Wm. Gilpin in the Coal Measures of Jackson county, and was presented to Dr. Norwood for the State Collection.

Littorina Wheeleri, n. sp.

Shell small, subglobose, granulated. Spire short, depressed; whorls three, convex; the last large and inflated; suture impressed; aperture slightly oblique, oval; surface covered with small semiglobular granules, each of which has a slight depression in its summit.

Length, .27; breadth, .23; length of aperture, .19; breadth of aperture, .14.

This unique little shell was discovered by Mr. Broadhead, in the Coal Measures of Monroe county.

CEPHALOPODA.

Nautilus Lawsii, n. sp.

Shell very large; septa very numerous and very convex; volutions depressed on the dorsal surface, somewhat flattened on the sides, and flattened or concave on the inner surface; taper gradual; aperture elliptical.

Diameter of the shell, 10.75 inches; length of aperture, 4 inches; width, 3.25.

This large and very rare fossil was discovered by President Laws of Westminster College, in the lower beds of the Hamilton rocks of Callaway county, where it is associated with *Strophodonta cymbiformis*, *S. navalis*, *S. Kemperi*, *S. inflexa*, and *Spirifer amarus*.

Nautilus Gilpini, n. sp.

Shell very large, flattened on the outer margin; whorls rapidly increasing; last chamber very large. Whorls few, much flattened on the outer margin; sharply rounded on the sides; the last is very large and nearly conceals the others;

umbilicus large, deep, cylindrical within, expanding rapidly outward; aperture wide and short, much modified by the preceding whorl; has a broad sinus in front; septa very convex, arched on the outer margin and nearly straight on the sides. The cast shows longitudinal striæ on the center of the outer margin of the whorls.

Width of aperture, 3.21; length of aperture, 2.05.

This fine Nautilus was presented to the Geological Survey by Col. Wm. Gilpin, who obtained it at Wayne City in the Coal Measures.

Goniatites Osagensis, n. sp.

Shell small, discoid, moderately convex, having internal, transverse strengthening ridges, which vary from four to six in the outer whorl, as indicated by the constrictions on the cast; umbilicus small, deep, slightly infundibuliform; septa form a broad, shallow, forward curve on the sides, and a more abrupt backward sinus on the dorsal margin; constrictions slightly curved; aperture large, 0.25 long and 0.30 wide; diameter of the shell, 0.88; whorls rounded on the dorsal margin, flattened on the sides.

This beautiful little species resembles *G. micronatus* of Phillips (Geol. York., Pl. XIX., p. 234), but is easily distinguished by the septa.

Abundant in the Chemung rocks of Cooper and Moniteau counties.

Goniatites (?) Holmesii, n. sp.

Shell flattened, discoid, sharply rounded on the dorsal margin; umbilicus rather small infundibuliform; whorls decreasing rapidly; aperture elongate; a rounded sinus in front; septa not seen; no constrictions on the cast.

Diameter of shell, 1.02; thickness, .30; length of aperture, .54; width of aperture, .38.

This fossil is less convex with a greater diameter than *G. Osagensis* above described.

Rare in the Chemung rocks of Cooper county; casts only have been obtained.

Goniatites Morganensis, n. sp.

Shell very small, gibbous, subdiscoidal, broadly rounded on the dorsal margin; umbilicus small, deep, subinfundibuliform; whorls tapering moderately, regularly rounded from the umbilicus to the dorsal margin; constrictions three or four deep and broad, scarcely flexuous; aperture short and broad; septa not seen; casts only discovered.

Diameter, .38; thickness, 21; length of aperture, .10; width of aperture, .23.

large size in our alluvial bottoms. The vines of smaller size on our dry ridges, which produce larger grapes with more juicy and palatable pulp, undoubtedly belong to *V. æstivalis.*

2. *Vitis æstivalis* of Prof. Swallow, "the largest of all our vines," "with stems like huge cables," can not be any thing but the same *Vitis cordifolia;* while the variety "of the limestone ridges," etc., probably has to be referred to the true *V. æstivalis.*

3. *Vitis cordifolia* is erroneously considered a smaller plant than those enumerated under 2 and 3. The true *V. cordifolia* and its variety, 4. *V. riparia*, which forms complete transitions into the former, are by far the largest American grape-vines.

5. *Vitis vulpina*, Lin., differs essentially from all the other grape-vines by its smooth bark, which is never shaly, like that of all others. It bears very large berries in very small clusters, and is known in the South as *Fox Grape* (whence the Linnean name), *Muscadine* or *Bullet Grape.* I have seen it abundantly in Arkansas, but never in Southern Missouri, though it may extend so far northward. Possibly it has been confounded with a species of grape which in Southern and Southwestern Missouri and in Western Arkansas and the adjoining Indian country is common on the gravelly banks of the smaller streams, which are overflowed during freshets. My specimens of this plant are not complete enough to class it with perfect confidence, but they indicate a close alliance and probably identity with *Vitis rupestris*, Scheele, of Western Texas, characterized by a low, bushy, rarely climbing stem; small, roundish, glabrous leaves, coarsely dentate, almost truncate, or with a broad sinus at base; by middle sized berries, in small bunches, of pleasant taste. It has much the growth and appearance of the Muscadine, but can always be distinguished by the shaly bark of the stem and the lighter colored leaves.

The wild muscadine grape as well as its cultivated variety, the Scuppernong, has been grown in gardens about St. Louis, but has never, I believe, borne fruit, showing that our climate does not suit it.

No. 6, *Vitis bipinnata*, Torrey & Gray, and 7, *Vitis indivisa*, Willd., can not come into consideration in a review of our native grape-vines, which considers only their economical value, as they do not bear edible fruit. They belong to the section *Cissus* (genus *Cissus*, Lin.) together with *Vitis incisa*, Nutt., which is found from Florida to Texas. *Vitis indivisa* is common throughout the State, especially in the valleys of our larger rivers. *Vitis bipinnata* is a southern species and was not observed by me north of Arkansas, though it may occur in the southern parts of the State.

Elevation of St. Louis above the Gulf of Mexico.

By George Engelmann, M.D.

A knowledge of the exact altitude of St. Louis is important as an element in the physical geography of North America, not only for the reason that this city stands, so to say, in the centre of the great Mississippi Valley and not far from the confluence of the four great rivers, the Mississippi, the Missouri, the Illinois, and the Ohio, but, also, because most of the hypsometrical measurements throughout the northern and western regions of this valley and into New Mexico and Utah, made by the different explorers during the last twenty years and more, by Nicollet, Fremont, Owen, Wislizenus, Emory, Stansbury, and several of the Pacific Railroad exploring expeditions, took the altitude of St. Louis as their starting point, and were based to a great extent on the barometrical observations of those explorers compared with mine.

Mr. J. N. Nicollet was the first who ascertained the elevation of St. Louis as well as a great many points on the Mississippi and Missouri Rivers, as he was the first to give us a physical geography of the Mississippi Valley, based on careful instrumental observation. He laid down an abstract of his labors in his Report on the Hydrographical Basin of the Upper Mississippi, in 1841, published by order of the U. S. Senate, after his death, in 1843. On pages 93–101 he gives a detailed account of the methods employed to obtain the desired results, and on pp. 122–125 is contained a most valuable table of geographical positions, distances, and altitudes.

In this table, p. 123, the altitude of St. Louis is stated to be 382 feet. The additional remark, "garden of the Cathedral," can only refer to the latitude and longitude, the observations for which were made in that garden*; the altitude is undoubtedly that of the "surface of low water in the Mississippi," as is evident from the heading of the table p. 122, and from the note p. 123. The exception in the note ("except when otherwise specially expressed") can not refer here as it does to the "level of the front pavement of the Cathedral" of New Orleans, or to the "level of the pavement of the Catholic church of Ste. Geneviève;" if it did, the altitude of low water mark at St. Louis would have to be reduced by 59 feet (the elevation of the then garden of the Cathedral above low water), which would bring it down to 323 feet—1 foot lower

* This garden was situated on the west side of Second street, between Walnut and Market streets, elevated about 2¼ feet above the present street. It has been dug down, many years since, and covered with store buildings. In a summer-house in this garden Mr. Nicollet made many of his observations.

than low water at the mouth of the Ohio, as given in the same table.

The data for Mr. Nicollet's calculation were his own barometrical levellings all along the Mississippi river, and observations made here by the Rev. Mr. Van Sweevelt of the St. Louis University and by myself. The data about the level of localities in St. Louis, and especially about the low water mark, he received from the late Mr. R. Paul, then city engineer, who had assumed it to be 28 feet 6 inches below the City Directrix,† or 2 feet higher than subsequent experience (especially during January, 1840) proved it to be. It is therefore necessary to subtract this amount from his 382 feet, which gives us 380 feet as the altitude of our present low water mark.

Dr. A. Wislizenus next calculated the elevation of St. Louis above the Gulf. His results are published in his Report on a tour to Northern Mexico, printed by order of the U. S. Senate, in 1848, p. 140. He found, by comparing his observations made at the seashore near the mouth of the Rio Grande with the cotemporaneous ones made by me here, the altitude of the City Directrix (which by mistake is stated to be 38 ft. 1 inch instead of 30 feet 6 inches above low water) to be 420 feet, which will bring the altitude of low water to 389 feet 6 inches.

Desirous of verifying these results, I availed myself in December, 1853, of the kind offers of assistance of the late Prof. Edw. H. Barton of New Orleans, and transmitted to him one of my barometers, which he compared with his instrument during more than four months, from January 3 to May 12, 1854.‡ The barometer sent, E. 2., ranged 0.080 inches lower

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† The top of the curbstone at the intersection of Market street and the Levee is called the City Directrix, to which point all the elevations in the city are referred. In January, 1840, Mr. H. Kayser, then city engineer, found that this point was elevated 30 feet 6 inches above the lowest stage of the river experienced for many years, and it is so stated on the high water mark erected a few feet south of the same place in commemoration of the flood of 1844, which reached this point on June 27th. This high water mark is 7 feet 7 inches above the City Directrix, and 38 feet 1 inch above low water. The Mississippi river had only once, since the foundation of the city, risen to a similar height, viz. in April of the memorable "*Année des grandes eaux,*" 1785. From some indefinite data in the recollection of the oldest inhabitants, it was supposed that the river was then even a foot or so higher than in 1844. The low water mark of 1840 is the one now considered as the correct one.

‡ What a glorious addition to our knowledge of the configuration of the North American continent would it be, if the Smithsonian Institution, which receives the barometrical observations from over 300 stations throughout the length and breadth of the land, would have the barometers of all observers carefully compared, so that accurate calculations of the altitudes of each could be made. By connecting these altitudes with the railroad surveys extending over the whole country, very important results would be obtained. It is hoped that the plan proposed by the In-

than my standard, E. 1., when I sent it, and 0.070 lower after it was returned, so that the mean difference was assumed to have been 0.075 inches. Dr. Barton found his instrument, B., on an average 0.045 inches lower than E. 2., which would give its rate at 0.120 inches below E. 1.

The 282 corresponding observations at New Orleans and St. Louis, extending over a time of more than four months, give the following average results after correction for the difference of rate:

	New Orleans.	St Louis.	
Barometer,	30.125	29.584	Eng. inches.
Attach. Therm.	66.88	53.01	degrees Fahrenheit.
Open air Therm.	59.09	40.80	" "

These results converted into metrical measure for the application of the tables of Delcros, as published by the Smithsonian Institution, give

	New Orleans.	St. Louis.	
Barometer,	h=765.17;	h'=751.42	millimetres.
Attach. Therm.	T= 17.16;	T'= 11.68	degrees Centigr.
Open air Therm.	t= 15.06;	t'= 4.89	" "

	Metres.
Table I. gives - - - - - - - h =	8204.5
h' =	8060.1
Approximate elevation of E. over B. - - -	144.4
Table II., correction for temperature of Barom. T'—T	7.1
	137.3
Correction for temperature of air:	
15.06×4.89=19.95×2=39.80	
39.80×137.3 divided by 1,000= - -	5.46
Table III., Latitudes 38° 30' and 30°; mean 34° 15'; correction - - - - - - -	0.15
Table IV., correction for decrease of gravitation -	0.35
Corrected elevation of E. over B. - - - - -	143.26

Engelmann's barometrical station over Barton's station - -	143.26 metres, or 469.8	Eng.	ft.
B. above Gulf, according to Dr. Barton's statement, - - - - - - -	11.1	"	"
E. above Gulf. - - - - - - -	480.9	"	"
E. above City Directrix - - - - -	76.0	"	"
City Directrix above Gulf - - - - -	404.9	"	"

stitution, some time ago, to obtain the aid of the different State governments for the distribution of correctly rated standard instruments and for monthly and yearly publications of the results obtained, will be carried out.

	Bro't over,	404.9	Eng. ft.
Low water below City Directrix - - - -		30.5	" "
Low water above Gulf - - - - -		374.4	" "

This gives the elevation of St. Louis a few feet lower than either of my predecessors has found it. The following shows the different results:

	Nicollet.	Wislizenus.	Engelmann.
Engelmann's barometrical station above Gulf, . -	486.5	496.0	480.9 ft.
City Directrix do. do.	410.5	420.0	404.9 "
Low water mark do. do.	380.0	389.5	374.4 "

Intimately connected with the altitude of St. Louis and other points along our river is the question of the fall of the river and the velocity of its current. Nicollet's tables, mentioned above, give us the only data at present available for an approximative estimation of the fall of the Mississippi in its different sections. The following little table, calculated from these data, explains itself:

	DISTANCE IN MILES.		FALL IN FEET.		Fall of the River in feet per mile.
	From point to point.	Total from St. Peters.	From point to point.	Total from St. Peters.	
Mouth of St. Peter's River to					
Prairie du Chien, - -	260	260	102	102	0.39
Rock Island, - - - -	210	470	114	216	0.54
Mouth of Desmoines, -	128	598	84	300	0.65
St. Louis, - - - - -	204	802	62	362	0.30
Mouth of Ohio, - - -	174	976	58	420	0.33
Mouth of White River, -	462	1438	122	542	0.26
Natchez, - - - - -	348	1786	116	658	0.33
New Orleans, - - -	302	2088	76	734	0.25
Mouths of Mississippi, -	104	2192	10	744	0.09
Or in the great natural sections of its course:					
Mouth of St. Peter's River to					
Prairie du Chien, - -	260	260	102	102	0.39
Mouth of Desmoines, -	338	598	198	300	0.59
New Orleans, - - -	1490	2088	434	734	0.29
Mouths of Mississippi, -	104	2192	10	744	0.09
Total average fall of the Mississippi from mouth of St. Peter's River to the Gulf,					0.34

The Mississippi River has therefore an average fall of about 4 inches per mile; between St. Peters and the Rapids, a little more; from the lower end of the Rapids to New Orleans, a little less; in the region of the Rapids, about 7 inches; and from New Orleans to the mouth, about 1 inch per mile. A further analysis of the tables shows the fall on both rapids to be 21 inches to the mile.

The rise and fall of the Mississippi River,* the velocity of its current, its volume of water, and the quantity of solid matter carried down, are most important elements in the natural history of our river, not yet solved, not even approached yet.

In the absence of all other information, the following few data, though based on rather loose observations made by me many years since, may be of some interest; the river opposite the city was, at that time, not yet confined between its present narrow banks.

Date of Observation.		Height of River above low water.		Current per hour.		One mile in	
1845.	Feb. 20,	5	feet,	3.00	miles,	20	minutes.
"	" 28,	10	"	3.50	"	17	"
1844.	Mar. 5,	15	"	4.00	"	15	"
"	Ap. 26,	20	"	5.00	"	12	"
1839.	May 27,	21	"	5.09	"	11¾	"
1837.	July 10,	27	"	5.55	"	10¾	"
1844.	May 19,	27	"	5.68	"	10½	"
"	Jun. 22,	35	"	6.25	"	9¾	"

* The great city of St. Louis with its magnificent river and with the greatest river trade perhaps of any city on the globe, extending thousands of miles north and south and east and west, has not yet to this day an established mark for the measurement of the stage of the river, nor has it been made the duty of the city engineer, or the superintendent of the water works, or the harbor master, to record the daily variations of its surface. All we know about the stage of the river is from vague newspaper reports and from our river pilots, who keep an eye on the depth of the channel.

METEOROLOGICAL TABLE FOR 1859—ST. LOUIS, MO.—By DR. G. ENGELMANN.

MONTHS.	BAROMETER, Reduced to Freezing Point.				THERMOMETER, (Fahrenheit.)				Evaporation.	Force of Vapor.	Relative Humidity.	Quantity of Rain and Snow.	Prevailing Winds.	Amount of Cloudiness.	No. of Thunderstorms.
	Mean of the observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.	Mean of the observations made daily at 7, 2 & 9 o'clk.	Highest.	Lowest.	Range.							
Jan.	29.697	**30.304**	29.142	1.162	33.5	58.5	—1.0	59.5	2.8	0.139	73	2.32	W.	4.6	—
Feb.	29.526	29.925	29.050	0.875	37.8	77.0	8.0	69.0	3.0	0.166	76	5.35	S.E. & W.	5.0	4
Mar.	29.316	29.764	**28.516**	1.248	48.9	78.0	28.0	50.0	5.7	0.207	60	7.32	W. & S.E.	5.6	4
April	29.424	29.758	28.958	0.800	52.3	82.0	28.0	54.0	6.0	0.236	61	4.89	W.	5.2	5
May	29.485	29.818	29,169	0.649	68.9	85.0	48.5	36.5	6.6	0.481	68	6.60	E., S.E. & S.	4.7	10
June	29.544	29.965	29.350	0.615	73.3	93.5	44.0	49.5	7.9	0.522	65	11.02	S.E., S. & N.W.	4.1	6
July	29.557	29.867	29.268	0.599	80.1	**98.0**	53.0	45.0	8.9	0.645	64	5.54	E. & S.	2.6	2
Aug.	29.487	29.728	29.295	0.433	76.8	92.0	57.0	35.0	8.2	0.590	66	2.93	E., N.E. & N.	3.3	2
Sept.	29.544	29.900	29.211	0.689	67.1	82.5	47.0	35.5	5.7	0.469	72	4.44	W., N.W. & S.E.	5.1	6
Oct.	29.618	29.988	29.146	0.842	54.4	80.0	27.0	53.0	6.5	0.249	61	1.80	S.E. & W.	2.8	1
Nov.	29.557	29.973	29.061	0.912	47.3	75.5	15.0	60.5	4.3	0.224	69	5.43	S.E., S. & W.	5.2	1
Dec.	29.660	30.103	29.170	0.933	25.0	49.0	**—3.5**	52.5	1.7	0.106	79	3.76	W. & S.E.	5.5	1
1859.	29.534	30,304	28.516	1.788	55.4	98.0	—3.5	101.5	5.6	0.336	67.7	61.40	W. & S.E.	4.5	42

NOTE.—Corrections for Meteorological Table for 1858, page 524:—The highest elevation of the Barometer in September was 30.179, not 30,129. The amount of cloudiness in April, May, July and September was 5.6, 6.7, 3.8 and 2.1; and not 6.6, 5.7, 3.6 and 2.2.

JOURNAL OF PROCEEDINGS.

June 6, 1859.

The President, Dr. WISLIZENUS, in the chair.

Nine members present.

Letters were read from I. A. Lapham, Milwaukie, May 21, 1859, acknowledging the receipt of the Transactions, No. 3; from Gov. Ralph R. Lowe, Keokuk, Iowa, May 23, 1859, in reply to a letter of the Corresponding Secretary, requesting a copy of Prof. Hall's Report of the Geological Survey of Iowa; from Prof. G. C. Swallow, Columbia, Mo., May 19, 1859, transmitting a paper, by Dr. B. F. Shumard, on the Geology of Ste. Geneviève County, for publication.

The following publications were received: Rep. of the 26th Exhibition of Amer. Manuf., by the Franklin Institute, Phil., 1858, *from the Institute;* Proc. Acad. Nat. Sciences, Phil., April, 1859, *from the Academy;* Rep. of U. S. & Mex. Boun. Survey, by Maj. W. H. Emory, Vol. II. Botany & Zoölogy, Wash., 4to, 1859,—Rep. of Superint. U. S. Coast Survey for 1857, Wash., 4to, 1858, *from the Hon. Trusten Polk;* Canad. Jour. of Ind. Sci. & Art, May, 1859, *from the Canad. Institute;* Explor. and Surveys of Pacific R. Routes, Vol. IX., Wash., 4to, *from Dr. C. A. Pope.*

Dr. M. M. Pallen presented a dried specimen of the expelled ovum-sack of a large marine mollusk, showing the embryos already formed, with some remarks on embryological development in these animals.

Dr. Pope presented specimens of *Cyathophyllum.*

Dr. Wislizenus presented a lithographic portrait of Alexander von Humboldt, which was ordered to be framed and hung up in the Hall of the Academy.

Dr. Wislizenus also presented quite a large collection of minerals and fossils, consisting chiefly of specimens of lignite from Iceland; lava, sulphur, and salts, from Vesuvius; quicksilver ore, talcose slate, quartz, ferruginous sand, and magnetic iron, from California; ammonites and trilobites from Germany; fossil fish from the Tertiary formation in Syria; geological specimens from the Bosphorus; lead ores from Galena, Ills.; marble from the foot of Mt. Olympus, Asia Minor; Tertiary fossils from Mt. Vernon; mineralogical specimens and fossils from El Paso, N. Mex.; Cretaceous fossils from Texas and Arkansas; gold and silver ores from Chihuahua;—most of the specimens having been collected by himself.

The thanks of the Academy were voted to Dr. Wislizenus for this valuable donotion.

A paper by Dr. B. F. Shumard, entitled "Observations on the Geology of the County of Ste. Geneviève," was read by the Corresponding Secretary. Referred to the Committee on Publication.

June 20, 1859.

The President, Dr. Wislizenus, in the chair.

Five members present.

The following works were received: Explor. & Surveys of Pacific R. Routes, Vol. X., Wash., 4to,—Map of Explorations in Nebraska Ter. in 1855–6–7, by Lieut. G. K. Warren, U. S. A., *from the Hon. Trusten Polk;* Reply to Criticisms of James D. Dana, by Jules Marcou, Zurich, 1859, *from the Author;* Jour. Frankl. Inst., Phil., No. 6, June, 1859, *from the Institute;* Proc. Boston Soc. Nat. Hist., Vol. VII., June, 1859, *from the Society;* Zeitschrift der deutschen geol. Gesellschaft, Berlin, 1858, *from the Society.*

The Corresponding Secretary communicated a translation of a paper by Prof. Jules Marcou, enclosed to him in a letter from Mr. Marcou, dated Zurich, May 23, 1859, for publication in the Transactions of the Academy, entitled "Notes on the Geology of Kansas and Nebraska," which was read and referred to the Committee on Publication.

Dr. Engelmann remarked that nearly eight inches of rain had fallen during the night of Saturday last, the 18th, and up to this morning, the 20th June, inst.

Dr. McPheeters presented a spear from the Feejee Islands.

Mr. Holmes presented a specimen of fire clay from the farm of Dr. J. D. Fyler, in St. Louis county, being probably from a continuation of the same deposit as that found near Cheltenham, five miles from St. Louis.

July 18, 1859.

The President, Dr. Wislizenus, in the chair.

Eight members present.

A letter was read from Prof. Joseph Leidy, Curator of the Acad. Nat. Sciences, Phil., dated the 22d June, 1859, transmitting three boxes of specimens in Natural History for the Museum of theAcademy in exchange for specimens received; also, a letter from the Secretary of the Smithsonian Institution, June 21, 1859, accompanying a collection of bird skins presented to the Academy by Capt. John Pope, U. S. A., as determined and labelled by Prof. S. F. Baird, with a list of numbers corresponding to the Smithsonian catalogue. Letters severally acknowledging the receipt of the Transactions of the Academy, and transmitting publications in exchange, were received from the Royal Asiatic Soc., London, May 14, 1859; Natural Hist. Soc. of Northumberland, Durham and Newcastle-upon-Tyne, May 5, 1859; Geological Society of London, May 19, 1859; Society of Arts, Manuf. & Comm., Adelphi, London, May 6, 1859; Société géographique Imp. de Russie, St. Petersbourg, 1859; Kön. Sächische Gesellsch. der Wissensch., Leipzig, Feb. 14, 1859; K. K. geol. Reichsanstalt, Wien, Nov. 23, 1858; K. K. geogr. Gesellsch., Wien, Sept. 2, 1858; Werner-Verein zur geol. Durschf. von Mähren u. Schlesien, June 25, 1858; Académie des Sciences, Arts et Belles-Lettres de Dijon, Nov. 7, 1858; Verein für vaterländ. Naturk. in Würtemberg, Stuttgart, Dec. 5, 1858; Naturf. Verein in Augsburg, 1858; Naturf. Gesellsch. in Bern, Jan. 1859; Allgemeine Schweiz. Gesellsch. f. d. gesammten Naturw., Bern, Jan. 1859. Letters were also read from L. T. Wells, July 9, 1859; from Prof. W. P. Riddell, Austin, June 13, 1859, acknowledging his election as a Corresponding Member; from Charles F. Loosey, Esq., Austrian Consul at New-York, dated July 2, 1859, concerning a package from the Imperial Academy of Vienna; and from the Smithsonian Inst., Wash., July 2, 1859, transmitting packages from Europe.

The following publications were received; Proc. Acad. Nat. Sciences, Phil., May, 1859, *from the Academy;* Sketches of the Hist. of Ogle Co., Ills., 1859, *from the Author;* Conservatory Jour., Vol. I., No. 7, Boston, 1859, *from the Editor;* Cat. of N. Amer. Birds, by Spencer F. Baird, Ass't Sec. S. I., Wash., 4to, 1858, *from the Author;* N. O. Med. & Sur. Jour., July, 1859, *from the Editors;* Proc. Elliott Soc. Nat. Hist., Charleston, S. C., 1857–8, *from the Society;* Proc. Boston Soc. Nat. History, June, 1859, *from the Society;* Atti dell' I. R. Istituto Lombardo, Vol. I., Fasc. vi.–x., Milano, 1858, *from the Imperial Institute;* Jahrb. der K. K. geol. Reichsanstalt, IX. Jahrg., No. 1–3, 1858, Wien, *from the Imperial Society;* Mittheil. der K. K. geogr. Gesellsch. II. Jahrg. Heft. 2–3, 1858, Wien, *from the Imperial Society;* Atti dell' I. R. Istituto Veneto, Tomo III., Ser. iii., Disp. 9–10, 1857–8, *from the Imperial Institute;* Verhandl. u. Mittheil. des siebenbürgischen Vereins für Naturw. zu Hermanstadt, IX. Jahrg., No. 1–6, 1858, *from the Society;* Gelehrte

Anzeigen der k. bayer. Akad. der Wissensch., Band 45–46, München, — Ueber neuaufgefundene Dichtungen Francesco Petrarca's, von Prof. Dr. Georg Martin Thomas, München, 1858; Ueber die geschichtl. Vorstufen der neueren Rechtsphilosophie, von Prof. Dr. Carl Prantl, München, 1858,—Ueber Johannes Müller, von Prof. Dr. Th. L. W. Bischoff, München, 1858, *from the Royal Bavarian Academy;* Siebenter Jahresb. über die Wirksamkeit des Werner-Vereins zur. geol. Durschf. von Mähren u. Schlesien, 1857, *from the Society;* VII. Bericht der Oberhess. Gesellsch. für Natur-und Heilk., Giessen, 1859, *from the Society;* Correspondenz-Blatt des zool.-mineralog. Vereines in Regensburg, XII. Jahrg., 1858, *from the Society;* Mem. de l'Acad. Imp. de Dijon, Ser. II., Tome VI., 1857, *from the Imperial Academy;* La Bourgogne, Revue Œnologique et Viticole, par C. Ladrey, Prof. de Chimie, 1er Livr., Jan. 1859, Dijon, *from the Author;* Würtemb. naturw. Jahreshefte XV. Jahrg., Heft 1-2, 1859; *from the Society in Wurtemburg;* Bericht des Naturk. Vereins in Augsburg, VIII.-XI., 1855–8,—Uebersicht der Flora, von Augsburg, 1850, *from the Society;* Entomol. Zeitung, XIX. Jahrg., Stettin, 1858, *from the Society;* Archiv des Vereins der Freunde der Naturg. in Meklenburg, Heft 1, 1847, Heft 6–12, 1852–8, *from the Society;* Untersuch. über die Wirkung des alkohol. Extractes der *Tanghinia venifera*, von A. Kölliker u. E. Pelikan, 1858, *from the Authors;* Mittheil. der naturf. Gesell. in Bern, 1855–6–7, *from the Society;* Actes de la Soc. Helvétique, 1851–7, *from the Society;* 38th Rep. of the Council of the Leeds Phil. & Lit. Soc., 1857–8,—China and its Trade, by John Crawfurd, F.R.S.,—Proc. Geol. & Polytech. Soc. W. Rid. of Yorkshire, 1857–8,—Comets, by Christopher Kemplay, Leeds, 1859, *from the Society;* Mem. Amer. Acad. of Arts & Sci., Vol. VI., Part 2, 1859,—Proc. of same, Vol. III. & IV., *from the Academy;* Jour. Frank. Inst. Phil., July, 1859, *from the Institute;* The Scalpel, "Laws of Health," &c., by Edw. H. Dixon, M.D., July, 1859; *from the Editor;* Rep. on the Hist. & Prog. of the U. S. Coast Survey, 1858,—Popular Account of the U. S. Coast Sur., 1858,—Astronomical Notices, being a Letter from Prof. O. M. Mitchell, Albany, June 13, 1859, *from Dr. Geo. Engelmann.*

The Corresponding Secretary read an extract from a letter addressed to him by Dr. B. F. Shumard, State Geologist of the State of Texas, dated Austin, June 12, 1859, touching his late discovery of Lower Silurian rocks, equivalent to the Potsdam Sandstone and Calciferous Sandrock of the New-York System, in Burnet county, in that State, as follows:

"I have been working lately in Burnet county, which lies just north of Travis, where the capital is located. My observations have been of the highest interest. I have discovered there an extensive development of

Lower Silurian rocks, equivalent to the Potsdam Sandstone and Calciferous Sandrock of the New-York System. The Potsdam Sandstone is filled with Trilobites belonging to the old genus *Arionellus*, with *Obolus* and *Lingula*, and a small *Orthis*, and it rests directly upon the granite. Above the Potsdam, we have beds which appear to represent the 3d Magnesian Limestone and 2d Magnesian Limestone of the Missouri Survey, above which is a compact lithographic-like limestone with a few species of *Orthoceras* and obscure remains of Trilobites. This may possibly represent the Birdseye Limestone of the N. York System. The thickness of these strata can not be less than a thousand feet. The Cretaceous strata, filled with *Exogyra Texana*, *Gryphæa Pitcheri*, and numerous other Cretaceous fossils, rest unconformably upon this primordial series in most instances, but sometimes we have Carboniferous strata reposing directly upon them, with perhaps a few feet (not exceeding fifty) of Devonian rocks between. The Trenton Limestone, Hudson River Group, all the Upper Silurian, nearly all the Devonian, and the Chemung, appear to be entirely wanting, the Carboniferous resting directly upon the oldest Palæozoic. But the final result must await a more careful examination of the fossils than I have as yet had time to make of them."

Dr. McPheeters presented a specimen of lead ore from Hunts's mines, two miles from De Soto, Mo., and a fossil dicotyledonous leaf in ferruginous sandstone, found by Dr. Clark, in the neighborhood of Pike's Peak, Kansas Ter.

The following specimens were received from the Academy of Nat. Sciences of Philadelphia in exchange: casts of Radius and Ulna of *Megalonyx Jeffersonii*, and 10 casts of bones of the toes of the same, from the originals described by Thomas Jefferson, now in the cabinet of the Philadelphia Academy; casts of a metatarsal bone and four toes of *Dinornis giganteus*, and 3 bones of *Dinornis*, collected in New Zealand by W. Mantell; 18 bones and teeth of Horse, Ox, Deer, Wolf, and Bear, from the Bone Caves of England and the Jura Mts.; 4 fragments and tooth of the *Iguanodon* from Tilgate forest, England; 4 bones and tooth of *Equus Jervillæus*, from Auvergne, France; teeth of three species of Sharks, and earbone and vertebra of a Cetacean, from the Red Crag, Suffolk, England; section of vertebra of *Plesiosaurus* from the Lias, England; 3 coprolites, 2 polished, of *Icthyosaurus*, from the Lias, England; teeth of *Lamna* from the Greensand, New Jersey; fragment of a Cetacean rib from the desert of Atacama, Peru; 50 species of Tertiary shells; 3 fragments of fossil fishes from the Chalk of England; scales of *Lepidotus* from the Wealden, England; 70 Bird skins, selected and labelled by Mr. Cassin; and a box of minerals and fossils from Mr. Wm. S. Vaux.

The Corresponding Secretary was directed to communicate the thanks of the Academy to Prof. Leidy, Curator of the Academy of Nat. Sciences of Philadelphia, for this very liberal return.

A Collection of Bird skins, consisting of 103 numbers, was received from the Smithsonian Institution, and presented to the Academy in the name of Capt. John Pope, having been

Transactions of the Academy, and transmitting publications in exchange; also, a letter from Dr. B. F. Shumard, Austin, Texas, dated Sept. 30, 1859, giving intelligence of the progress of the Geological Survey of Texas, in which he writes as follows:

"During the last two months, I have been working in the Tertiary; but, save in a few instances, fossils are very scarce, and particularly mammalia. We find here the Mastodon and Mammoth. The Tertiaries of Eastern Texas consist of sandstones, clays, immense deposits of iron ore and lignite. No other mammals than those above named have yet been discovered. I have studied the Tertiary with much care, and another season will be necessary to enable me to do justice to it. The Bluff formation exists here in great perfection, and I shall endeavor to say something upon it hereafter that will interest you."

The following donations to the Library were received; Proc. Amer. Phil. Soc., Philad., Vol. VII., Jan.-June, 1859, *from the Society;* Trans. & Coll. of the Amer. Antiq. Soc., Vols. I.-III., 1820-1857, *from the Society;* Proc. Boston Soc. Nat. Hist., Vol., VII., Sept., 1859, *from the Society;* Jour. Frank. Inst., Phil., Oct., 1859, *from the Institute.*

Dr. T. C. Hilgard exhibited spines, fins, and bones of fishes, illustrating the comparative anatomy of this and other classes of Vertebrata, in reference to organotactic laws and the phyllotactic numbers 3 and 5.

He remarked, that all bones originate from points or "centres" of ossification, out of a preëxistent matrix. The large tubular bones, such as the humerus and femur, as well as the radius, ulna, tibia and fibula, originally present FIVE — not merely, as is erroneously maintained in anatomical repositories, three — centres, only one of which in fistular bones develops into the axial prolongation or "diaphysis"; while *two*—not one—"*apophyses" at either extremity*, as is seen in these specimens, form, the one, a collum or capitulum; the other, a trochanteric, or, as the case may be, a sesamoid or olecranon tuberosity. All are *separate ossification points*. At the onward extremes they form, one, the ginglymoid articulation, or the onward "apophysis"; the other, a semilunar (humerus) or "styloid" (radius, ulna) appendage. Respecting their torsion or "divergence" of centres, the two centres of each double apophysis relate to the axial element as diagonally opposite, at different heights, such as the collum and trochanter femoris, and the fossa sigmoidea and olecranon of the ulna: and respecting the mutual relation of these diagonals at either extreme, they are found more or less to traverse each other, so that the longitudinal ridge of the fistular element retains a position intermediate; as in a phyllotactic cycle the first and second elements, and the fourth and fifth, are crosswisely opposites, while the third stands between. In all these respects, fistular bones correspond to a branch of five segments, the middle one of which is alone developed as a true internode, or joint, as of a bamboo-reed, petrified, and replete with succulent marrow; while the rest take emphatically the embryonic and subsequent total development of *teeth*, with a now spongy cavity, an osseous coat, and enamel cup or sherd; and it is this dentine form or ossicular type which is due to the ova degenerated into cysts replete with teeth or "*dentified ossicles.*"

Respecting the appendages by which the motor system is attached to the spine, *its development is a ternate or quinary cycle*, developed rather in a *plane*, and the elements *radiately* disposed; that is, the various types of pelvic, scapular, temporal, tympanic and pterygoid attachments to the neural spine, five in all, severally, vary in different classes so as, in many instances, to assume mutually the same pelvic, scapular, temporal, etc., developments respectively interchanged, as it were. In the "shoulder-ring" of fishes, where the scapula is the chief *crescented blade*, in the simile of a bird's ileum, and is made to join its partner of the other side underneath the gullet—as an indentured synchondrosis, mostly—the clavicle, like a bird's ischium attached to the *middle of the (ileoid) scapula*, with its caudate exsinuate extremity, forms a true simile (*although in a shoulder*) of the *arcus pubis* in mammals; while the versatile, lithe, piscine *coracoid element* (originally, in young mammals likewise *sejunct*) takes much of the loose appearance of the bifurcate, sternally coalescing *aviary coracoid*, no less than the long, attenuated, and retrorsely equitant, slender os pubis of birds, and synchondrosed with the retrorsely equitant ischium, which leaves but a ligamentous-coated *slit* for a foramen obturatium, and an "obturated" remnant of the ischiadic passage between itself and the *retrorsely prolonged ileum it joins behind.* All this is exhibited in the collection to be presented when completed.

In birds, the *coracoid* is but loosely connected with the *slender scapular blade* and the *flat and exsinuate-caudate clavicle—which stems the sternum* (or fusion of collateral mesial ossicles of costal origin)—and, as a manubrial attachment, is fused with its partner of the other side into a gothic arch of intersecting beams.

The *acromis* — rectangularly synchondrosed with the scapula in mammals—and the articulated, and hence independent, not merely residual, *marginal cartilage*, are a fourth and fifth centres, deficient in the adult bird skeleton, but already strongly developed in fishes, for the attachment of the scapular blade to the neural arch by the intervention of the mostly bifurcate (connective ossicle or) *marginal terminal*, joining the second cranial vertebra and mastoid. These quinary components are fully retained in the batrachian shoulder, *where all five are formed into a tabulate expanse*, and the humerus transversely articulates to a more or less cylindric element, as a transformation occurring mostly in the clavicle.

Respecting the temporal attachment, which in young sheep, man, and Cyprinoid fishes, e. g. the buffalo-fish, (Catostomus sp.) can be separately detached, leaving but the labyrinthically runcinate os petrosum (a single independent rib of the neural spine, and having a perforation for a specific nerve between its own capitular, tubercular and costal centres): the squamous part repeats the blade, ileum or scapula—as the comparison may be instituted—with an acromial projection or proc. zygomaticus, bearing a terminal *connective ossicle;* while its exsinuate-caudate element, circumscribing an aperture, in mammals forms the meatus auditorius osseus; in turtles, the infundibuliform auditory drum, or tympanic cavity, in some cases immediately opening into the campanulate-inflated, vast and retrospectant mastoid space, leaving a *dentine vacuum* inside; but in porcine and ruminant mammals, and the feline tribe, representing the ear-drum projecting *underneath* the skull, with a cancellate trabecular tissue: and all three—or, as the processes are disjointed, *five*—parts of the temporal region are but a simile of all the other fulcral attachments, forming glenoid articulations for the support of the jaws and other prehensile levers, or, as the case may be, dissections of continuous layers of flesh, as in Articulata—where exactly the same parts are preformed, as "*insections.*"

In mammals the temporal glenoïs bears the weight and pressure of the mandible. In birds, the depression of the temporal cleidoid (meatus externus) is stemmed into by the palatal cleidoid—with mammals (see previous contributions) the lamina pterygoidea externa; while the aviary mandible (as in fishes, and amphibia likewise) swings on the top of this disjointly compound processus pterygoideus, and in birds is suspended merely by a strong *sinew* from the obsolete temporal projections. In fishes, the true auditory ossicles—as erroneously called auditory as in man!—

are by the gigantic incus-bone of a radiate-dentine conformation, articulated or lengthily soldered into the glenoid region, being a true analogue to a fulcral attachment for the support of the huge hyoid-prehensils, their gill-fins representing the ear-cartilages as a manual termination, and, contrary to all authors, not bearing, but merely, as a manubrium, joining, the independent thoracoid formation or cephalo-thorax of five pairs of cephalic ribs—supposing them to be the true ventral arches for the five corresponding neural ones of the cranium. This hyoid shoulder consists of an *exsinuate-caudaté cleidoid* (the incus of higher vertebrates) articulating into the temporal glenoidal cavity; an anterior crescented slab, sutured with the flat-vaulted palatals, as a cuspidate element or *stapes*, circinately contorted in some turtles; a cuspidate-crescented zygomatic is agglutinated to the cleidoid (a blade for the pterygoid fabric), behind which operates a lid in likeness of a *shovel* or *scapula*—no unmeaning words, as indicative of early application of bones to utensil purposes—terminated by an ensiform marginal (in likeness of the orbicular fold or felly of the tympanum, as in mammals,) and issuing into an acromoid process, in mammals, as in fishes, the "*styloid*" process, whence the hyoid bones, as an extremity (in fishes of an immense size), are suspended: their humeral, ulnary and radial being in immediate succession: the ascendant horn, the horizontal and the (semi)hyoid; as, indeed, in man, where, unconscious to anatomical *exegesis*—too deplorably conducted on foul human corruption, *instead on its living exposé, the animal realm!*—the ascending "horn" of the hyoid fabric is indeed descending, and the mesial connection of the hyoid arches its carpoidal extremity: whereof the muscular *tongue* forms the tactitive, the *tragus and helix of the ear*, by dislocation, the receiving phalangal bone-system!—in fishes representing a *fin of phalanges* semicartilaginous and joining the tympanic fabric, and already, by intuitive comparison popularly emphasized as "*fish-ears*"! Here the humeral, depending from the opercular bones' junction, is cartilaginous; the ulnary, as its immediate successor, the so called posterior hyoid, a strong, broad beam of fin, as also its insequent element, or, if so be, a true simile of a radius.

The ginglymoid *pter. ext.*—immediately indentured with the malar prolongation of the radiate-dentified incus-prop—is backed by its strong sejunct *hamulus, style* and *zygomatic blade*, and in fishes, as in amphibia and birds likewise, supports the mandible, here dislocated from its proper glenoid groove to that extent: exposing a system where several fulcral radiations—here, the temporal, opercular and palatal—are in immediate uniform connection; *bearing at a common centre* the three contingent prehensilia, the hyo-auditory, the pterygo-facial, and the mandibular. Many bones are, it is apparent, only single ossifications; so are the single teeth as single ossifications and the carpal and tarsal elements; which in the human hand are *eight* (an organo genetic number), in that of certain dolphins are *five*. The phalangal bones are each a ternal ossification, but in number, as far as supernumerary to their respective metacarpals, metatarsals, etc., vary in *Delphinus globiceps* from 1, 2, 8, 13; in man from 2 to 3 only; while the carpals of the dolphin are reduced in number to the next cyclar number below, being merely 5. The phalangal fin-rays of muscalounges, perches, torpedoes, etc., vary among such organogenetic members as numbers 13, 21, 55,—and, as in the ichthyosauri, are often ramified in the fan-like expanse of the fins.

In insects, the insection of limbs frequently has this form: fronting a belt bearing a limb, we perceive a plate of tabulate mail, analogous to the frog-shoulder (see above), issuing into a collum, the inflated joint in jumping bugs and grasshoppers; and next a segment of sesamoid contraction, and *giving a fulcrum in an angular sense* as a trochanter or tuberculum costæ, to which is attached, in angular continuity, a long "femur"—or the true simile of the *femoral diaphysis!*—followed, in linear serial arrangement, by the 2, 3, 5, and, in antennæ, higher organogenetic numbers of phalangoid elements, (each higher one the sum of the two previous ones). As to the neural and ventral arches, their costal type differs least from the insected type, being an intermediate form between the radially-expanded, tabulate-bladed one of fulcral attachments and the prehensile levers' fistular bones: each dorsal, cranial or ventro-thoracal rib—in full array so very complete in many fishes—consisting of a capitular attaching centre: in ribs the capitulum, in dorsal arches the stemming interspinal (buffalo-fishes) or capitular joint, in the first or condylar cranial vertebra the condyle-plate; next, a trochanteric tuberculum or anterior process of dorsal vertebræ; next, a blade, in ventral spines the rib-arch proper, in compressed piscine ventral as well as dorsal spines the immediate pectinate series, in the caudal region in either spine to an identity alike, but at the incumbence of soft voluminous entrails changed, so as to form ship-like arches: while, as the presented specimens of the nuchal vertebræ of Bubalichthys show to satisfaction, the pectinate series of the neural spine transforms towards the head, and *in* the head, into what is the identical organ with the processus transversus of the human thoracic, anteriorly fully beribbed vertebræ, so as to exclude any doubt at their proper *dorsal* origin and interpretation. The capitulum in birds is very much prolonged, in a shortened cleidoid form colligate with the transverse dorsal process (with ensiformly developed tubercular elements, in a parrot, presented) and the well-known side-slabs, as distant tubercula, are oversliding the rib-arches near their middle. The spinous processes of mammals and higher vertebrata (in many cases presented normally open at the summit—atlas of young hog, with sejunct tooth of epistropheus: the epistrophean arch being *double*, the *dens* reproducing a vertebral base; atlas of sea-turtle) are the doubly laminate, ventrally removed, but elsewhere insident caudal and dorsal poniards—in the gar-fishes (Lepidosteus) actually *connate-insident as true proc. spinosi* to the connivent lateral arch-beams, and often crowned by powerful, yet in high adult states still bifid fin-rays, the cartilaginous processus cartilaginei of the processus spinosi. These are repeated on the ventral spine, in fishes as an identical formation, in inflated-ribbed vertebrata, e. g. as the dorsal fin of the dolphin, and on the ventral side, as the cartilages and the originally bifid (embryonic state) sternum: the costal cartilages, or incident "poniards," repeating the dorsal poniards (or processus spinosi).

In fishes, the capitulum costæ in the herring tribe forms a cartilaginous *cube* soluble from the spinal column, and jointed to the setiform side-slab (tubercle) and setiform rib-blade; in dog-fishes (Amia), gars, etc., the capitulum is confluently fixed to the column, the rib-blade articulating at its projected apex; in the small perches and pomotis-forms of our waters the capitula are a series of pointed pegs projecting from the column, and are jointed loosely to the merely applied subrotary blades, bearing sidewise the loose spiniform tubercula: which in trout, pike, and muscalounges, are *transplanted upon the column, forming a second series of bristly ribs*, subtending the flesh at half angles between the spine and ribs proper; while in the codfish, where a part of the spinal processes is laminately flattened out sideways, the likewise *foliate-expanded* (continuous) *capitula* bear at their apex both the setiform short rib and proportionately long, upwardly subtending tuberculum-bristle: all of which being left *out of consideration*, to say the least, in our present ichthyognostic dictionaries or handbooks, it cannot be astonishing that so little success has been arrived at in determining the "catholic" (or, respecting a pantoscopic view) proposition of their relation and relationship: a fault of diagnostic science without the proffered aid of philosophic pantoscopic corroboration. The body being subtended longitudinally by a system of block-masonry developed *bilaterally*, with only the cartilaginous pellucid menisci as a *true* mesial formation (both the sternal as well as apical elements being originally bigeminate) it *is* to be assumed a tree of life composed of cycles, of a low number (2 to 5 at most) of subcartilaginous primogenital centres; each section or joint of vertebral form bearing *four* branches, two dorsal and two lateral or ventral arch-beams, each of 1, 2, 3 or 5, in insected flesh increased cyclar numbers of centres: at either side forming a stiff-ribbed arch, nave or gangway, originally open (bifid) but subsequently closed up; the dorsal collected by him in California, New Mexico, and Texas, and described and labelled by Prof. S. F. Baird, Asst. Sec. of the Smithsonian Institution, and numbered according to the Smithsonian catalogue.

The thanks of the Academy were directed to be communicated to Capt. Pope for his valuable donation.

The following additions to the By-laws were adopted:

ARTICLE IV.

§ 4. All drawings for plates to illustrate papers intended for publication must be furnished by the authors free of expense to the Academy, except that for special reasons, in particular instances, it may be otherwise determined by express vote.

§ 5. Every Associate Member, who is not in arrears for dues, shall be entitled to receive *gratis* from the Treasurer one copy of every future number of the Transactions of the Academy.

The Corresponding Secretary was authorized to transmit to Dr. B. F. Shumard, State Geologist of the State of Texas, one copy of Lieut. G. K. Warrens's Map of the U. S. Territories lying between the Mississippi River and the Pacific Ocean.

Mr. Samuel A. Coale, Jr., was elected an Associate Member.

August 1, 1859.

The President, Dr. Wislizenus, in the chair.

Eight memberspresent.

The following publications were received: Proc. Boston Soc. Nat. Hist., May, 1859, *from the Society;* Proc. Acad. Nat. Sciences, Phil., June, 1859, *from the Academy;* 7th Supp. to Dana's Mineralogy, *from the Author;* Ann. Rep. of the N. York State Library, Albany, 1859, *from the Trustees;* Texas Almanac for 1857–8–9, *from Dr. B. F. Shumard;* Canad. Jour. of Ind. Sci. & Art, July, 1859, *from the Canadian Institute.*

The Rev. T. H. Newton presented a catalogue of shells collected at Panama, a large shell (*Cassis rufa*), a collection of Echini, and a suite of geological specimens from the Island of St. Thomas.

August 15, 1859.

The President, Dr. Wislizenus, in the chair.

Seven members present.

The following works were received: Rep. U. S. & Mex. Bound. Survey, by Major W. H. Emory, U. S. A., Vol. II. Natural History, Wash., 4to, 1859, *from the Hon. F. P. Blair, Jr.;* Township Organization for Illinois, by a Farmer, Alton, 1859, *from the Author;* Jour. Frank. Inst. Phil., Aug., 1859, *from the Institute.*

Mr. James Buckland was elected an Associate Member.

September 5, 1859.

The President, Dr. WISLIZENUS, in the chair.

Nine members present.

Letters were read from the "K. Akad. der Wissenschaften," Vienna, Dec. 2, 1858, & Jan. 22, 1859, acknowledging receipt of the Transactions and transmitting publications in exchange.

Received the following works: Sitzungsb. der K. Akad. der Wissensch., Wien, math.-naturw. Classe. Band XXVIII., Nos. 1–26, 1858.,—"Almanach" of same, 1858,—Festreden von Dr. Geo. Karajan u. v. Ettingshausen, 1857,—Magnet. Beobacht. von Karl Kreil. II. Aufl., 1858, *from the Imperial Academy;* Proc. Boston Soc. Nat. Hist., July and Aug., 1859, *from the Society;* Proc. Acad. Nat. Sciences, Philad., July, 1859, *from the Academy.*

Dr. Engelmann exhibited specimens of several species of the genus *Verbena*, from this neighborhood, and of three hybrids between them.

He observed that hybrids were undoubtedly much more common in nature than is often anticipated; that hybrids among plants were well known in Europe, but that in this country very little attention had been paid to this important point in natural history. Some forms of oaks, at first considered as peculiar species, *Quercus heterophylla*, Michx., and *Q. Leana*, Nutt., were now, and no doubt correctly, viewed as hybrids; he himself had found two other hybrid oaks in this neighborhood, to be described in the forthcoming XVth Vol. of De Candolle's Prodromus; both of them were single plants, which have unfortunately been destroyed long since by the march of improvement. Our willows, no doubt, present numerous hybrids, which however have not yet been studied, as the European hybrid willows lately were. The only other genus known to him in North America which seems inclined to hybridization was *Verbena*. His attention had been early drawn to the hybrids of this genus, several of which were quite common in this neighborhood, and could be recognized by the practised eye even at a considerable distance. He had published an account of them, in 1844, in Silliman's Journal, vol. 46, pp. 99–101.

His recent investigations of three hybrids, *Verbena urticæfolio-stricta*, *V. stricto-bracteosa*, and *V. stricto hastata*, proved that the ovula were in all instances perfectly well developed; but the anthers were always small, incomplete, and often empty and withered before the flower opened: even when they were more developed and emitted some pollen, its grains were found to be small, shrivelled, and not containing any fovilla. Between these effète pollen-grains a small number of well developed ones was sometimes seen, but these were in every instance smaller than the pollen-grains of either parent plant.

In *V. urticæfolio-stricta* the empty pollen had about 0.008 lines in diameter, the well developed grains 0.016 to 0.017; the pollen-grains of *V. stricta* have a diameter of 0.023 to 0.024 lines, and those of *V. urticæfolia* one of 0.020 lines, and scarcely any incomplete ones are found among them. The plant is erect, taller than *V. stricta*, with larger and thinner leaves, with more elongated and slender paniculate spikes, with smaller and paler blue flowers, bearing very few seeds.

V. stricto-bracteosa is a prostrate plant with incised, three-lobed or almost pinnatifid leaves much larger than in *V. bracteosa*, of a firm texture, and hoary with elongated short-bracted spikes, and rather larger flowers. The pollen-grains were almost all effète, and 0.007–0.009 lines in diameter; the very few rather well developed ones seen had a diameter of 0.011 lines, while those of *V. bracteosa* have 0.018 lines.

The very slender but densely spiked *V. stricto-hastata* has small and pale blue flowers, intermediate in every respect between the flowers of the parents. The pollen was almost all incomplete and less than 0.008 lines in diameter, while in *V. hastata* it is 0.020 lines in diameter. The very distinct *V. hastato-stricta* with longer spikes, larger flowers, rougher incisely-serrate leaves, did not show any pollen at all, but matured some seeds.

These observations confirm the position of Dr. Klotzsch of Berlin, that in the hybrid the pollen is wanting, or becomes empty and inefficient for the propagation of the species, and that, the ovula being perfect, propagation can only take place by fecundation through the pollen of either of the parent plants, thus producing forms which eventually will return into the parent stock.

In some hybrids, however, as Prof. Caspary has observed in *Cytisus Adami*, the ovula also degenerate so that propagation by seed becomes impossible.

Dr. Heitzig presented two cases of coleopterous insects.

Dr. Pope presented a branch of Elder showing an exceedingly grotesque fungous degeneration, produced by an *Æcidium*.

Mr. Hermann Ehrenberg, Arizona, was elected a Corresponding Member, and Evans Casselberry, Esq., an Associate Member.

September 19, 1859.

Vice-President Dr. C. A. Pope in the chair.

Eight members present.

Donations to the Library were presented as follows: Bulletin mensuel de la Soc. Imp. zoologique d' Acclimatation, Tome VI., No. 7–8, July & Aug., 1859, *from the Society;* N. O. Med. & Surg. Jour., Sept., 1859, *from the Editors;* Jour. Frank. Inst., Phil., Sept., 1859, *from the Institute;* Trans. Roy. Scottish Soc. of Arts, Vol. V., Pt 2, Edinb., 1859, *from the Society;* Jour. Elliott Soc. Nat. Hist., Vol. I., part 1–2, 4to, Charlestown, 1859, *from the Society;* 7th Exhibition of the U. S. Agricul. Soc., Chicago, 1859.

Presentations of specimens were made as follows: Centipede, Tarantula, Moccasin Snake, and an Indian tobaccopouch made of the skin of a double-headed buffalo calf, *by Dr. McPheeters;* magnetic iron ore from Shepard's Mountain, *by Dr. Koch;* a box of minerals from Santa Fé, N. M., through Dr. C. A. Pope, *by Dr. Cavanaugh;* fossils, bones, skulls of buffalo, minerals, bird skins, and nests, *by Dr. E. J. Marsh*, collected by him on his late tour to the Upper Missouri River with the Amer. Fur Company's steamer, in company with Mr. C. P. Chouteau; also, a box of skins and furs, *by Capt. John Pope.*

H. L. Stieren, M.D., was elected an Associate Member.

October 3, 1859.

The President, Dr. Wislizenus, in the chair.

Fifteen members present.

A letter was read from Dr. C. A. Mann, dated Liberty, Ills., Sept. 15th, 1859, accompanying some fragments of sandstone and a small snake, supposed to have been found in a cavity in the solid sandstone, 15 inches below the surface, in which no fissure, or other opening, had been observed. On breaking the sandstone, the snake had appeared, in a small cavity, in a torpid state, but on exposure to the air it became active.

The sandstone was pronounced by Dr. Prout, judging from some fossils contained in it, to be of Carboniferous age.

The snake was directed to be sent to Prof. S. F. Baird, of the Smithsonian Institution, for examination and determination of the species.

Col. Wm. Gilpin exhibited several hydrographical maps of N. America, and made some remarks upon the geography and geology of the Pike's Peak Gold Region. He urged upon the Academy the propriety of memorializing Congress in behalf of a thorough exploration and geological survey of this valuable country. A committee was appointed, consisting of Drs. Wislizenus and Engelmann, Major M. L. Clark, Col. Gilpin, and Mr. Holmes, to take the subject under consideration and report thereon at a future meeting.

October 17, 1859.

The President, Dr. Wislizenus, in the chair.

Eight members present.

A letter was read, dated Oct. 2, 1859, from the Amer. Antiq. Society, Worcester, acknowledging the receipt of the

Transactions of the Academy, and transmitting publications in exchange; also, a letter from Dr. B. F. Shumard, Austin, Texas, dated Sept. 30, 1859, giving intelligence of the progress of the Geological Survey of Texas, in which he writes as follows:

"During the last two months, I have been working in the Tertiary; but, save in a few instances, fossils are very scarce, and particularly mammalia. We find here the Mastodon and Mammoth. The Tertiaries of Eastern Texas consist of sandstones, clays, immense deposits of iron ore and lignite. No other mammals than those above named have yet been discovered. I have studied the Tertiary with much care, and another season will be necessary to enable me to do justice to it. The Bluff formation exists here in great perfection, and I shall endeavor to say something upon it hereafter that will interest you."

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Dr. T. C. Hilgard exhibited spines, fins, and bones of fishes, illustrating the comparative anatomy of this and other classes of Vertebrata, in reference to organotactic laws and the phyllotactic numbers 3 and 5.

He remarked, that all bones originate from points or "centres" of ossification, out of a preëxistent matrix. The large tubular bones, such as the humerus and femur, as well as the radius, ulna, tibia and fibula, originally present FIVE — not merely, as is erroneously maintained in anatomical repositories, three — centres, only one of which in fistular bones develops into the axial prolongation or "diaphysis"; while *two*—not one—"*apophyses" at either extremity*, as is seen in these specimens, form, the one, a collum or capitulum; the other, a trochanteric, or, as the case may be, a sesamoid or olecranon tuberosity. All are *separate ossification points.* At the onward extremes they form, one, the ginglymoid articulation, or the onward "apophysis"; the other, a semilunar (humerus) or "styloid" (radius, ulna) appendage. Respecting their torsion or "divergence" of centres, the two centres of each double apophysis relate to the axial element as diagonally opposite, at different heights, such as the collum and trochanter femoris, and the fossa sigmoidea and olecranon of the ulna: and respecting the mutual relation of these diagonals at either extreme, they are found more or less to traverse each other, so that the longitudinal ridge of the fistular element retains a position intermediate; as in a phyllotactic cycle the first and second elements, and the fourth and fifth, are crosswisely opposites, while the third stands between. In all these respects, fistular bones correspond to a branch of five segments, the middle one of which is alone developed as a true internode, or joint, as of a bamboo-reed, petrified, and replete with succulent marrow; while the rest take emphatically the embryonic and subsequent total development of *teeth*, with a now spongy cavity, an osseous coat, and enamel cup or sherd; and it is this dentine form or ossicular type which is due to the ova degenerated into cysts replete with teeth or "*dentified ossicles.*"

Respecting the appendages by which the motor system is attached to the spine, *its development is a ternate or quinary cycle*, developed rather in a *plane*, and the elements *radiately* disposed; that is, the various types of pelvic, scapular, temporal, tympanic and pterygoid attachments to the neural spine, five in all, severally, vary in different classes so as, in many instances, to assume mutually the same pelvic, scapular, temporal, etc., developments respectively interchanged, as it were. In the "shoulder-ring" of fishes, where the scapula is the chief *crescented blade*, in the simile of a bird's ileum, and is made to join its partner of the other side underneath the gullet—as an indentured synchondrosis, mostly—the clavicle, like a bird's ischium attached to the *middle of the (ileoid) scapula*, with its caudate exsinuate extremity, forms a true simile (*although in a shoulder*) of the *arcus pubis* in mammals; while the versatile, lithe, piscine *coracoid element* (originally, in young mammals likewise *sejunct*) takes much of the loose appearance of the bifurcate, sternally coalescing *aviary coracoid*, no less than the long, attenuated, and retrorsely equitant, slender os pubis of birds, and synchondrosed with the retrorsely equitant ischium, which leaves but a ligamentous-coated *slit* for a foramen obturatium, and an "obturated" remnant of the ischiadic passage between itself and the *retrorsely prolonged ileum it joins behind*. All this is exhibited in the collection to be presented when completed.

In birds, the *coracoid* is but loosely connected with the *slender scapular blade* and the *flat and exsinuate-caudate clavicle—which stems the sternum* (or fusion of collateral mesial ossicles of costal origin)—and, as a manubrial attachment, is fused with its partner of the other side into a gothic arch of intersecting beams.

The *acromis* — rectangularly synchondrosed with the scapula in mammals—and the articulated, and hence independent, not merely residual, *marginal cartilage*, are a fourth and fifth centres, deficient in the adult bird skeleton, but already strongly developed in fishes, for the attachment of the scapular blade to the neural arch by the intervention of the mostly bifurcate (connective ossicle or) *marginal terminal*, joining the second cranial vertebra and mastoid. These quinary components are fully retained in the batrachian shoulder, *where all five are formed into a tabulate expanse*, and the humerus transversely articulates to a more or less cylindric element, as a transformation occurring mostly in the clavicle.

Respecting the temporal attachment, which in young sheep, man, and Cyprinoid fishes, e. g. the buffalo-fish, (Catostomus sp.) can be separately detached, leaving but the labyrinthically runcinate os petrosum (a single independent rib of the neural spine, and having a perforation for a specific nerve between its own capitular, tubercular and costal centres): the squamous part repeats the blade, ileum or scapula—as the comparison may be instituted—with an acromial projection or proc. zygomaticus, bearing a terminal *connective ossicle;* while its exsinuate-caudate element, circumscribing an aperture, in mammals forms the meatus auditorius osseus; in turtles, the infundibuliform auditory drum, or tympanic cavity, in some cases immediately opening into the campanulate-inflated, vast and retrospectant mastoid space, leaving a *dentine vacuum* inside; but in porcine and ruminant mammals, and the feline tribe, representing the ear-drum projecting *underneath* the skull, with a cancellate trabecular tissue: and all three—or, as the processes are disjointed, *five*—parts of the temporal region are but a simile of all the other fulcral attachments, forming glenoid articulations for the support of the jaws and other prehensile levers, or, as the case may be, dissections of continuous layers of flesh, as in Articulata—where exactly the same parts are preformed, as "*insections.*"

In mammals the temporal glenoïs bears the weight and pressure of the mandible. In birds, the depression of the temporal cleidoid (meatus externus) is stemmed into by the palatal cleidoid—with mammals (see previous contributions) the lamina pterygoidea externa; while the aviary mandible (as in fishes, and amphibia likewise) swings on the top of this disjointly compound processus pterygoideus, and in birds is suspended merely by a strong *sinew* from the obsolete temporal projections. In fishes, the true auditory ossicles—as erroneously called auditory as in man!—

are by the gigantic incus-bone of a radiate-dentine conformation, articulated or lengthily soldered into the glenoid region, being a true analogue to a fulcral attachment for the support of the huge hyoid-prehensils, their gill-fins representing the ear-cartilages as a manual termination, and, contrary to all authors, not bearing, but merely, as a manubrium, joining, the independent thoracoid formation or cephalo-thorax of five pairs of cephalic ribs—supposing them to be the true ventral arches for the five corresponding neural ones of the cranium. This hyoid shoulder consists of an *exsinuate-caudate cleidoid* (the incus of higher vertebrates) articulating into the temporal glenoidal cavity; an anterior crescented slab, sutured with the flat-vaulted palatals, as a cuspidate element or *stapes*, circinately contorted in some turtles; a cuspidate-crescented zygomatic is agglutinated to the cleidoid (a blade for the pterygoid fabric), behind which operates a lid in likeness of a *shovel* or *scapula*—no unmeaning words, as indicative of early application of bones to utensil purposes—terminated by an ensiform marginal (in likeness of the orbicular fold or felly of the tympanum, as in mammals,) and issuing into an acromoid process, in mammals, as in fishes, the "*styloid*" process, whence the hyoid bones, as an extremity (in fishes of an immense size), are suspended: their humeral, ulnary and radial being in immediate succession: the ascendant horn, the horizontal and the (semi)hyoid; as, indeed, in man, where, unconscious to anatomical *exegesis*—too deplorably conducted on foul human corruption, *instead on its living exposé, the animal realm!*—the ascending "horn" of the hyoid fabric is indeed descending, and the mesial connection of the hyoid arches its carpoidal extremity: whereof the muscular *tongue* forms the tactitive, the *tragus and helix of the ear*, by dislocation, the receiving phalangal bone-system!—in fishes representing a *fin of phalanges* semicartilaginous and joining the tympanic fabric, and already, by intuitive comparison popularly emphasized as "*fish-ears*"! Here the humeral, depending from the opercular bones' junction, is cartilaginous; the ulnary, as its immediate successor, the so called posterior hyoid, a strong, broad beam of fin, as also its insequent element, or, if so be, a true simile of a radius.

The ginglymoid *pter. ext.*—immediately indentured with the malar prolongation of the radiate-dentified incus-prop—is backed by its strong sejunct *hamulus, style* and *zygomatic blade*, and in fishes, as in amphibia and birds likewise, supports the mandible, here dislocated from its proper glenoid groove to that extent: exposing a system where several fulcral radiations—here, the temporal, opercular and palatal—are in immediate uniform connection; *bearing at a common centre* the three contingent prehensilia, the hyo-auditory, the pterygo-facial, and the mandibular. Many bones are, it is apparent, only single ossifications; so are the single teeth as single ossifications and the carpal and tarsal elements; which in the human hand are *eight* (an organo genetic number), in that of certain dolphins are *five*. The phalangal bones are each a ternal ossification, but in number, as far as supernumerary to their respective metacarpals, metatarsals, etc., vary in *Delphinus globiceps* from 1, 2, 8, 13; in man from 2 to 3 only; while the carpals of the dolphin are reduced in number to the next cyclar number below, being merely 5. The phalangal fin-rays of muscalounges, perches, torpedoes, etc., vary among such organogenetic members as numbers 13, 21, 55,—and, as in the ichthyosauri, are often ramified in the fan-like expanse of the fins.

In insects, the insection of limbs frequently has this form: fronting a belt bearing a limb, we perceive a plate of tabulate mail, analogous to the frog-shoulder (see above), issuing into a collum, the inflated joint in jumping bugs and grasshoppers; and next a segment of sesamoid contraction, and *giving a fulcrum in an angular sense* as a trochanter or tuberculum costæ, to which is attached, in angular continuity, a long "femur"—or the true simile of the *femoral diaphysis!*—followed, in linear serial arrangement, by the 2, 3, 5, and, in antennæ, higher organogenetic numbers of phalangoid elements, (each higher one the sum of the two previous ones). As to the neural and ventral arches, their costal type differs least from the insected type, being an intermediate form between the radially-expanded, tabulate-bladed one of fulcral attachments and the prehensile levers' fistular bones: each dorsal, cranial or ventro-thoracal rib—in full array so very complete in many fishes—consisting of a capitular attaching centre: in ribs the capitulum, in dorsal arches the stemming interspinal (buffalo-fishes) or capitular joint, in the first or condylar cranial vertebra the condyle-plate; next, a trochanteric tuberculum or anterior process of dorsal vertebræ; next, a blade, in ventral spines the rib-arch proper, in compressed piscine ventral as well as dorsal spines the immediate pectinate series, in the caudal region in either spine to an identity alike, but at the incumbence of soft voluminous entrails changed, so as to form ship-like arches: while, as the presented specimens of the nuchal vertebræ of Bubalichthys show to satisfaction, the pectinate series of the neural spine transforms towards the head, and *in* the head, into what is the identical organ with the processus transversus of the human thoracic, anteriorly fully beribbed vertebræ, so as to exclude any doubt at their proper *dorsal* origin and interpretation. The capitulum in birds is very much prolonged, in a shortened cleidoid form colligate with the transverse dorsal process (with ensiformly developed tubercular elements, in a parrot, presented) and the well-known side-slabs, as distant tubercula, are oversliding the rib-arches near their middle. The spinous processes of mammals and higher vertebrata (in many cases presented normally open at the summit—atlas of young hog, with sejunct tooth of epistropheus: the epistrophean arch being *double*, the *dens* reproducing a vertebral base; atlas of sea-turtle) are the doubly laminate, ventrally removed, but elsewhere insident caudal and dorsal poniards—in the gar-fishes (Lepidosteus) actually *connate-insident as true proc. spinosi* to the connivent lateral arch-beams, and often crowned by powerful, yet in high adult states still bifid fin-rays, the cartilaginous processus cartilaginei of the processus spinosi. These are repeated on the ventral spine, in fishes as an identical formation, in inflated-ribbed vertebrata, e. g. as the dorsal fin of the dolphin, and on the ventral side, as the cartilages and the originally bifid (embryonic state) sternum: the costal cartilages, or incident "poniards," repeating the dorsal poniards (or processus spinosi).

In fishes, the capitulum costæ in the herring tribe forms a cartilaginous *cube* soluble from the spinal column, and jointed to the setiform side-slab (tubercle) and setiform rib-blade; in dog-fishes (Amia), gars, etc., the capitulum is confluently fixed to the column, the rib-blade articulating at its projected apex; in the small perches and pomotis-forms of our waters the capitula are a series of pointed pegs projecting from the column, and are jointed loosely to the merely applied subrotary blades, bearing sidewise the loose spiniform tubercula: which in trout, pike, and muscalounges, are *transplanted upon the column, forming a second series of bristly ribs*, subtending the flesh at half angles between the spine and ribs proper; while in the codfish, where a part of the spinal processes is laminately flattened out sideways, the likewise *foliate-expanded* (continuous) *capitula* bear at their apex both the setiform short rib and proportionately long, upwardly subtending tuberculum-bristle: all of which being left *out of consideration*, to say the least, in our present ichthyognostic dictionaries or handbooks, it cannot be astonishing that so little success has been arrived at in determining the "catholic" (or, respecting a pantoscopic view) proposition of their relation and relationship: a fault of diagnostic science without the proffered aid of philosophic pantoscopic corroboration. The body being subtended longitudinally by a system of block-masonry developed *bilaterally*, with only the cartilaginous pellucid menisci as a *true* mesial formation (both the sternal as well as apical elements being originally bigeminate) it *is* to be assumed a tree of life composed of cycles, of a low number (2 to 5 at most) of subcartilaginous primogenital centres; each section or joint of vertebral form bearing *four* branches, two dorsal and two lateral or ventral arch-beams, each of 1, 2, 3 or 5, in insected flesh increased cyclar numbers of centres: at either side forming a stiff-ribbed arch, nave or gangway, originally open (bifid) but subsequently closed up; the dorsal one inlaid with all nervous connections with the brains or head-marrow, and with the openings at the side like a true *arca Noæ*—and riding on the abdominal side or vomitant channel of liquefied assimilative and secretive matter, confined in due subordination by the impending of the lower cross-beams, forming the chest, and, in a measure, the belly, thus confining the sensuous or assimilative and the sexual or secretive viscera.

On this subject much was known in ancient tradition in a pantoscopic symbol now entirely lost to understanding, but renovable in a new form, if implied as a tale no less than a genetic exegesis or exodus of the spirit out of the land of Egypt, as it were: the bodily conditions of the ensiform-bladed organism, so emphatically represented in the image of the pantoscopic snake of tradition, *as a general symbol of life.*

Dr. Pope presented specimens of gold-bearing rocks and earths from the Pike's Peak Gold Region.

Dr. Pollak presented, in the name of James G. Soulard, Esq., a fine specimen of lead ore, 300 lbs. weight, from the Lead Mines near Galena. Ills.

November 7, 1859.

Vice-President Dr. ENGELMANN in the chair.

Twelve members present.

Letters were read from the Royal Soc. of Sciences, Göttingen, May 23, 1859; I. R. Acad. di Sci., Lettere ed Arti di Padova, March 30, 1859; K. preuss. Akad. der Wissensch., Berlin, May 1, 1859; Senckenbergische Naturf. Gesell., Frankfurt-a-M., June 9, 1859; Naturh. Verein der preuss. Rheinl. u. Westphalens, Bonn, Feb. 10, 1859; Naturf. Gesellsch. in Emden, June 22, 1859; Vaterländ. Museum Francisco-Car. zu Linz, Feb. 10, 1859; K. K. zool.-bot. Gesellsch. in Wien, May, 1859; Herr Jenonez, Vienna, April 22, 1859, desiring to extend exchanges in the Austrian Empire; Royal Geograph. Soc., London, Aug. 13, 1859; circular letter of Dr. E. Ferreira Franza (in the service of the Brazilian Government,) and F. A. Brockhaus, Leipzig, Nov. 10, 1858, soliciting exchanges of publications; A. F. Bandelier, Highland, Ills., Oct. 28, 1859; E. C. James, Alton, Ills., Oct. 26, 1859; Western Acad. Nat. Sci., Cincinnati, O., Oct. 27, 1859; Librarian of Harvard Coll., Cambridge, Oct. 31, 1859; Essex Inst., Salem, Mass., Oct. 29, 1859; Prof. S. F. Baird, Wash., Oct. 28, 1859; Smithsonian Inst., Wash., Oct. 15, 1859,—severally acknowledging the receipt of the Transactions of the Academy, and announcing the transmission of publications in exchange.

The following donations to the Library were received: Canad. Jour. of Ind. Sci. & Art, *from the Canadian Institute;* Atlantis: a Register of Lit. Sci. & Art, Dublin, 1859, Nos. III.–IV., *from the Editors;* Bulletin de la Soc. des Sciences Nat.

de Neuchatel, Tomes I.–IV., 1847–1858, *from the Society;* Jahrb. der K.K. geologisch. Reichsanstalt, IX. Jahrg. No. 4, Oct.–Dec., 1858, Vienna, *from the Imperial Institute;* Mittheil. der K.K. geograph. Gesellsch., Wien, 1859, III. Jahrg. 1 Heft, *from the Imperial Society;* Nachrichten von der Georg-Augusts-Universität u. der K. Gesellsch. der Wissensch. zu Göttingen, No. 1–28, 1858, *from the Royal Society;* Zeitschrift für die gesammten Naturw., Halle, 1858, XII. Band, *from the Society in Halle;* Rivista della I. R. Academia di Padova, Vol. VI., Trim. 1–2, 1857–8, 3–4, 1858, *from the Imperial Academy;* Monatsb. K. preuss. Akad. der Wissensch. zu Berlin, July–December, 1858,—Ergebnisse der Wetterbeob. 1855,—Uebersicht der Witterung im nördl. Deutschland, 1856,—Meteor. Beob. 1855–8, *from the Royal Academy;* Verhandl. des Vereines zur Beförd. des Gartenbaues, VI. Jahrg. 2 Heft, 1858, Berlin, *from the Society;* Trans. of the Imp. Geograph. Soc. of Russia, Vol. I.–IV., 1853–58,—Compte-Rendu pour 1858, St. Petersburg, 1859, *from the Imperial Society;* Atti del' I. R. Istituto Veneto, Tomo IV., ser. iii. Disp. 1–5, *from the Imperial Institute;* Jahresb. der Senckenbergischen Naturf. Gesell. zu Frankfurt-a-M., 1 Jahrg, 1857, *from the Society;* Jahresb. der Naturf. Gesell. in Emden, 1858, *from the Society;* 39th Ann. Rep. of the Leeds Phil. & Lit. Soc., 1858–9,—Proc. Geol. Polytech. Soc. Yorkshire, 1858–9, *from the Leeds Society;* Sitzungsb. der Physicalisch-med. Gesell. zu Würzburg, *from the Society;* Bulletin de la Soc. Linnéenne de Normandie, Vol. III., 1857–8, *from the Society;* 8th Bericht über das Museum Francisco-Car. Linz, 1858, *from the Institution;* Verhandl. der K. K. zool.-bot. Gesellsch. in Wien, Jahrg. 1858, Band VIII., *from the Imper'l Society;* Jahresheft des Vereins des Krainischen Landes-Museum, Laibach, I.–III., 1838, 1856–58, *from the Museum;* Repertorio Ital°. per la Storia Nat. cura J. J. Bianconi, 1853, Fasc. 1–2, 1854, Vol. I.–II., Bononiæ, *from the Editor;* Floræ Forojuliensis Syllabus, J. A. Pirona, M.D., 1855,—Bemerkung über einige Arten der Gattung Centaurea, von Victor v. Janka, Wien, *from the Librarian of the Imp. Geol. Institute of Vienna.*

The Corresponding Secretary was directed to transmit 10 copies of Nos. 1, 2 & 3 of the Transactions of the Academy to the Librarian of the Imperial Geol. Institute of Vienna for exchanges in the Austrian Empire, in answer to the request contained in his letter of the 22d April, 1859.

Major M. L. Clark presented some minerals from Arkansas and Indiana; also, sandstone slabs, containing fossil footprints, from the valley of the Connecticut River, both above and below Northampton, Mass.

Mr. Edwin Harrison read a paper entitled "The Preservation of the Indian Languages, by E. W. Prewitt."

November 21, 1859.

Vice-President Dr. ENGELMANN in the chair.

Thirteen members present.

Letters were received from the Smithsonian Institution; W. Sharswood, Cavendisham, Pa.; N. Orleans Acad. of Nat. Sciences; I. A. Lapham, Milwaukie, Wis.; Library of the Univ. of Michigan, Ann Arbor; Amherst Coll.; Edward H. Beebe, Galena, Ills.; R. B. Price, Columbia, Mo.; N. York State Library, Albany, — severally acknowledging receipt of the Trans. of the Academy.

Donations to the Library were announced as follows: Rep. of Superin. U. S. Coast Sur. for 1857, Wash., 4to, 1858,— Cong. Globe, 2d Sess. 35th Cong., by J. C. Rives, Wash., 4to, 1859, *from the Hon. F. P. Blair, Jr.,;* N. O. Med. & Surg. Jour., Nov., 1859, *from the Editors;* Bibliographia Entomol. by W. Sharswood, Leipzig, 8vo., 1 sheet, *from the Author;* Proc. Acad. Nat. Sciences, Phil., Aug., 1859,—Catalogue of Invertebrata of N. America, *from the Academy;* Geol. Sketch of Estuary & Fresh Water Deposits of Judith River, by F. V. Hayden, M.D.,—Extinct Vertebrata from the Judith river, and Great Lignite Formations of Nebraska, by Joseph Leidy, M.D., Phil., 1859, *from Prof. J. Leidy;* Description of deformed fragmentary Human Skull, from an ancient cave at Jerusalem, by J. Aitkin Meigs, M.D., Phil., 1859, *from the Author;* Jour. Frank. Inst., Phil., Nov., 1859, *from the Institute.*

A communication was read from I. A. Lapham, Esq., of Milwaukie, Wis., announcing that he had discovered rocks near Milwaukie, equivalent in age to the Old Red Sandstone (Devonian) of Europe, and containing remains of Fishes, resembling those discovered by Hugh Miller in Scotland. The remains did not show the entire fish, but consisted of fragments of bones, teeth, and fins, with portions of the tuberculated, shagreen-like dermal covering. The rocks lie above those of the Niagara group (Silurian), and are the newest of the rock formations proper yet discovered in Wisconsin.

Prof. G. Seyffarth communicated the following letter addressed to him from Prof. O. M. Mitchell, Director of the Dudley Observatory at Albany, relating to the astronomical inscription on the Leeds Mummy-Coffin, described and interpreted by Prof. Seyffarth in the last number (No. 3, Vol. I., p. 356) of the Academy's Transactions:

"DR. G. SEYFFARTH. — Dear Sir: I received a short time since your article on the Astronomical Inscription on the Leeds 'Mummy Coffin.' I was so deeply interested in this remarkable exposition, that I at once requested one of my assistants, Dr. Sonntag of the Dudley Observatory, to compute for me the places of the sun, moon, and planets, at the autumnal equinox, 1722 B. C.

"This work has been completed, and his computations agree well with your own. He finds at Paris, noon, 1722 B. C.,

The Sun's longitude	179° 57′	
The Moon's apparent longitude	24° 48′	
Mercury's longitude	219° 47′	Retrograde.
Venus' "	191° 87′	
Mars' "	147° 14′	
Jupiter's "	100° 80′	
Saturn's "	231° 49′	

"These results agree with your own, and I am now desirous of obtaining from you a brief history of the method by which you reached to the knowledge of the "Key" which seems to unlock all these astronomical inscriptions.

"I should be glad to obtain from you sketches of the hieroglyphics which represent the sun, moon, and five old planets; also, the representations of the 12 Signs of the Zodiac, and one or two additional inscriptions like the one in your pamphlet on the Leeds Mummy Coffin.

"I have already alluded to your great discovery in one of my public lectures, and am desired to prepare a discourse on this special subject, to be given in this city sometime in December.

With great respect, very truly,

O. M. MITCHELL."

Prof. Seyffarth read the first part of a paper on a "Remarkable Papyrus-Scroll, written in the Hieratic character, about 1050 B. C."

Mr. Edwin Harrison presented a small sandstone slab, imprinted with bird tracks, from the valley of the Connecticut; also, a specimen of aluminate of Lead, showing some oxychloride of Lead; also, a specimen of Silver ore, containing an average of 62.08 ounces to the ton of 2000 lbs. of ore, from the St. Louis Mines of Arizona.

December 5, 1859.

The President, Dr. WISLIZENUS, in the chair.

Thirteen members present.

A letter was read from W. Sharswood, Cavendisham, Philad., Nov. 21, 1859, in which he observes that, during the latter part of the year 1857, his attention had been attracted to a peculiarity of the oxide obtained from the East Bradford Allanite, Chester Co., Penn. The composition of the mineral as determined and published by Rammelsberg in the "Annalen der Physik u. Chimie von Poggendorf," LXXX. 285, is:

$\dddot{Si}$,	$\dddot{Al}$,	$\dot{Fe}$,	$\dot{Ce}$,	$\dot{Ca}$,	$\dot{Mg}$,	$\dot{La}$,	$\dot{Fe}$.
31.86,	16.87,	12.26,	21.27,	10.15,	1.67,	2.40,	3.58.

At the time of his observing the above fact it was a question whether there be really a new oxide present combined with the oxide Cerium, closely related to it in the figure of its equivalent, or simply a second oxide with which it had not hitherto been known to be associated. The fact referred to consisted in the observation, that in its deportment with the tests for oxide Cerium, it would not yield the characteristic reactions. These facts seemed to demand an investigation of the subject, and he had determined upon undertaking the task.

Letters were read from Dr. P. W. Mosblech, Bethany, Va., and from the Librarian of Yale Coll., New Haven, acknowledging receipt of the Transactions No. 3.

Donations to the Library were presented as follows: Rep. of Expl. & Surv. of Pacific R. Routes, Vol. X., Wash., 4to, 1859,—Cong. Globe, 2d Sess. 35th Cong., Part I., 1858–9, *from the Hon. F. P. Blair, Jr.;* Canad. Jour. Ind. Sci. & Art, Nov., 1859, *from the Canadian Institute;* Jour. of Education, Nos. 1–10, Vol. III., Montreal, 1859, *from Capt. L. A. Huguet-Latour.*

Dr. T. C. Hilgard read a letter from Prof. S. F. Baird, Washington, relating to the small snake supposed to have been found imbedded in solid sandstone, near Liberty, Ills., (mentioned in the letter of Dr. C. A. Mann, which was read at a former meeting, dated Sept. 15, 1859,) which was as follows:

"SMITHSONIAN INSTITUTION, Washington, Nov. 23, 1859.

"Dr. T. C. HILGARD.—Dear Sir: I have just received your letter and the snake at the hands of Mr. H. Engelmann. On examination, I find it to be a species well represented in our Museum; but all the specimens are from Missouri, and as yet we have no evidence of its existence out of your State. Dr. Engelmann has sent it from near St. Louis. It was described last spring by Mr. Kennicott as *Celuta vermis*, (Proc. Acad. Nat. Sciences, Philad.) I send you an extra with his article.

"It is of course sufficiently evident that the introduction of the snake into its rocky cavity is of comparatively recent origin. It may have occupied it without food for many months, perhaps for more than a year. I should judge this to have been the case by its somewhat emaciated appearance. Very truly yours,

S. F. BAIRD."

The Corresponding Secretary communicated an extract from a letter of Dr. B. F. Shumard, dated Austin, Nov. 14, 1859, touching his recent discoveries of extensive Coal Measures in Northern Texas, which was as follows:

"My trip to Fort Belknap was one of great interest. We have found a large development of Coal Measures, filled with numerous characteristic fossils, many of them the same as occur in the Coal strata of Missouri and Illinois. The beds consist of sandstones, limestones, and selenite shales, surmounted with conglomerate. Before the commencement of our survey, coal was supposed to exist here in "shallow bands of no great thickness and of little value," and many supposed that the coal was merely lignite. But we have traced the boundaries of the Coal Measures so far as to be able to say, that the area occupied by this formation is not less than 4,500 square miles, and perhaps much greater. The vertical range of the formation has not yet been determined accurately, but it cannot fall short of 400 feet. We have seen four different beds of coal in the same section, the thickest being nearly four feet. The clays and shales accompanying the coal are filled with beautiful crystals of selenite, larger than the palm of one's hand, and abound in elegantly preserved fossils, among which we recognize many Missouri friends. The conglomerate is from eighty to one hundred feet thick."

Dr. C. W. Stevens exhibited a botanical specimen which had the hygrometrical property of expanding, when wet, and coiling up into a ball, when dry.

Dr. Engelmann designated it as *Selaginella lepidophylla*, a well-known cryptogamous plant, found abundantly in south-western Texas, in Mexico, and as far as California, as ascertained by the U. S. Boundary Exploration. *Selaginella* is a lycopodiaceous genus of numerous, especially tropical, species, of which few only exhibit this hygrometrical peculiarity. The three species of the eastern U. States, one of which, *S. rupestris*, is also found in our State, and extends throughout North and South America and Asia, do not have this property.

Henry Engelmann, Geologist, Washington, D. C., and Amos H. Worthen, State Geologist of the State of Illinois, were elected Corresponding Members.

December 19, 1859.

The President, Dr. Wislizenus, in the chair.

Eight members present.

Letters were read from Messrs. A. H. Worthen, Springfield, Ills., and H. Engelmann, Washington, D. C., severally acknowledging their election as Corresponding Members; also, from Prof. P. W. Mosblech, Bethany, Va., acknowledging receipt of publications.

Donations to the Library were received as follows: Dyas et Trias, ou le Nouveau Grés Rouge en Europe, dans l'Amérique du Nord et dans l'Inde, par Jules Marcou, Genève, 1859, *from the Author;* Bulletin mens. de la Soc. Imp. zool. d'Acclimatation, Tome VI., No. 10, Oct., 1859, *from the Society;* Rep. on Geol. and Mining Districts of the Iron Mt. R.R., by J. V. Phillips, St. Louis, 1859, *from the Author;* Jour. of Education, Montreal, Nov., 1859, *from Capt. L. A. Huguet-Latour.*

Prof. G. Seyffarth, concluded the reading of his paper entitled "A Remarkable Papyrus-Scroll, written in the Hieratic character about 1050 B. C.," illustrated by a fac simile and translation of the characters; to which was added some remarks upon the System of Champollion, in reply to the criticisms of Mr. Le Page Renouf.

On motion, it was ordered that the fac simile and translation be lithographed, and, together with the paper of Dr. Seyffarth, be published in the Transactians of the Academy.

William Sharswood, Ph. D., of Philadelphia, and Prof. P. W. Mosblech, Ph. D., of Bethany Coll., Va., were elected Corresponding Members.

January 2, 1860.

The President, Dr. WISLIZENUS, in the chair.

Thirteen members present.

Letters were read from the Elliott Soc. Nat. Hist., Charlestown, Dec. 15, 1859, and from the Werner-Verein zur geol. Durschf. von Mähren u. Schlesien, Brünn, Jan. 20, 1859, acknowledging receipt of the Transactions of the Academy, and announcing the transmission of publications in exchange.

The following donations to the Library were received: Jour. Frank. Inst., Phil., Dec., 1859, *from the Institute;* Proc. Acad. Nat. Sci., Phil., Nov., 1859, *from the Academy;* Cat. of 1st Exhibition of Statuary & Paintings, Chicago, 1859; Nautical Monographs, No. 1, Observatory, Wash., Oct., 1859, by Lieut. M. F. Maury, *from the Author;* Jahrb. der K. K. geol. Reichsanstalt, X. Jahrg. 1, Wien, 1859, *from the Institution;* Mem. et Doc. publiés par la Soc. Historique de Montreal, 2d Livr., 1859, *from Capt. L. A. Huguet-Latour;* Texas Almanac for 1860, & Richardson's New Map of Texas, 1860, *from Dr. B. F. Shumard;* Atti dell' I. R. Istituto Veneto, Tomo VI., Ser. iii., Disp. 6--7, 1859, *from the Institution;* Verhandl. des Vereins zur Beförd. des Gartenbaues, Berlin, 1858, VI. Jahrg., 1 Heft, V. Jahrg., 3 Heft, 1857, *from the Society;* Württemb. naturw. Jahreshefte, XV. Jahrg., 3 Heft, Stuttgart, 1859, *from the Society;* Uitvinding der Boekdrukkunst, Haarlem, 1854, sm. 4to,—Uitvinding der Boekdrukkunst, door J. J. Noordziek, Haarlem, 1848,—Verslag van der Directie der Overijss. Vereen. tot Entw. van Prov. Welvaart, 1857–8–9, *from the Society;* VIII. Jahresb. des Werner-Vereines, 1858, Brünn, *from the Society;* Proc. Boston Soc. Nat. Hist., Oct.–Nov., 1859, *from the Society.*

Prof. G. Seyffarth communicated the following letter from George A. Stone, Esq., of Roxbury, Mass., relating to the Papyrus-Scroll and other objects mentioned in the paper read by him before the Academy at a late meeting:

"Boston, December 20, 1859.

"Prof. G. Seyffarth, D.D.—My Dear Sir: Your kind favors of the 16th inst. and 28th Nov. last past, enclosing translations of the Scarabæus Tablet and a portion of the Papyrus-scroll, came duly to hand. I believe I sent you a sketch of the tomb and entrance in which they were found, and thinking it will interest you, I will relate how they came into my possession. While at Thebes, I went out to shoot eagles, and one of the mountaineers who was with me said he could show me something better, and then produced the gold spread-eagle, of which I wrote you, and wished me to buy it. I refused, thinking it was worth only its weight in gold. He came aboard my boat the next evening, and showed me the Papyrus and Tablet. I was then sure he had found the body of some person of consequence; so I purchased all three. I then started down the river, and when I arrived at Kenet, I had come to the conclusion that there were other articles still belonging with the Papyrus-scroll, and I sent my dragoman back to Thebes to bring the man and anything of value he might have: and when he came, he produced the Scarabæus, which I purchased. He stated that he had lived at Thebes forty years, and had never seen a mummy so carefully and perfectly preserved; that it was covered with linen of a texture nearly as fine as silk; that the head of the mummy was covered by a mask painted and gilded; and that in the upper room stood four jars of oriental alabaster, with figure heads, the whole covered with hieroglyphics and enclosed in a box of hard yellow wood, also covered with inscriptions. The upper room he discovered in 1857, and the lower room in 1858. The jars and box he sold to Lord Henry Scott, a young Englishman, and they are probably in his possession. The mask he sold to a Copt who collects and sells antiquities at Thebes, and the Copt transferred it to the French Consular Agent at that place, and it is either in his possession, or in the French Museum at Paris. The Tablet was tied around the neck of the mummy by a string, the Scarabæus lay on the breast, and the Eagle and Asp were nailed on the top of the mummy-case.

Your obd't serv't,

GEORGE A. STONE."

A paper presented for publication by A. H. Worthen, State Geologist of the State of Illinois, entitled "A Notice of a new species of Platycrinus and other fossils from the Mountain Limestone of Illinois and Iowa, being an extract from the 2d Annual Report of the Illinois Geological Survey," was read by the Corresponding Secretary. Referred to a committee.

A paper presented for publication by A. H. Worthen, State Geologist, entitled "Review of some points in Dr. B. F. Shumard's Report on the Geology of Ste. Geneviève Co., Mo.," was read by the Corresponding Secretary, and referred to a committee.

A letter was read from Dr. John Evans of Washington, D. C., with the correspondence enclosed, relating to the large mass of Meteoric Iron discovered by him in the Rogue River Mts., at no great distance from Port Orford, on the Pacific coast, in Oregon, and soliciting the countenance of the Academy in furtherance of the efforts now being made to induce the U. S. Government to cause the same to be accurately examined and described, or, if practicable, removed to Washington and deposited in the Museum of the Smithsonian Institution.

The matter was referred to the President, with instructions to address such letters as he might deem proper and advisable to Prof. Joseph Henry, Secretary of the Smithsonian Institution, our Representatives in Congress, and other personages at Washington, in behalf of the proposed object.

The President submitted his Annual Report of the progress and proceedings of the Academy during the year 1859:

ANNUAL REPORT.

Another year, the fourth of the existence of our Academy, has passed, and in renewing it we may congratulate ourselves that our efforts and results within the last year have at least been commensurate with our means. Our meetings have been regularly attended, our Museum and Library have received considerable additions, there has been no want of verbal and written communications on scientific subjects, which were uniformly discussed in a most liberal spirit, and the third number of our Transactions, more voluminous than the previous ones, and we trust equally as interesting to the scientific world, was published towards the close of the year.

Our communication with other Societies of similar tendency, at home and abroad, has been kept up by our Corresponding Secretary with great punctuality. By the transmission of our Transactions, for which we are greatly indebted to the Smithsonian Institution in Washington City, we receive in exchange regular files of very valuable scientific publications from all parts of the world, which may form the nucleus of a future Library of Natural Sciences. The total number of our foreign exchange list is at present 128, and that of the home list 67. In order to maintain this desirable intercourse, we are obliged to continue our own publications; but if the state of our finances should not allow us to publish every year so full a number, we might at least publish occasionally separate articles in sheets.

Besides the addition which our Library has received by exchange, it has been incréased by private donation and by many valuable public documents, for which we are under obligations to the Hon. Trusten Polk and the Hon. Frank P. Blair.

Our Museum has also been enlarged by liberal donations in nearly all its departments, thus:

Ethnology has received valuable contributions from Mr. B. M. Southerton, Mo.; Rev. C. H. A. Dall, Calcutta; Dr. McPheeters, St. Louis.

Mammalogy, from Chas. P. Chouteau, Esq., Dr. E. J. Marsh, and Dr. Engelmann.

Ornithology, from Capt. J. Pope, U. S. A., and in exchange from the Academy of Natural Sciences, Philadelphia. (A great many of these birds have been prepared and elegantly mounted, but we need more cases to preserve them properly.)

Herpetology has received additions from Drs. Engelmann, McPheeters, and Sander, St. Louis, and Dr. Wheeler, Perry Co., Mo.

Entomology, from Drs. McPheeters, A. Leitch, and others.

Botany. Prof. E. W. Hilgard, State Geologist of Mississippi, presented a collection of about three hundred plants from the State of Mississippi.

Palæontology and *Geology*. Donations were made in this department by Drs. Pope, McPheeters, Engelmann, Wislizenus, Maj. Clark, C. Witter, Esq., and in exchange we received from the Academy of Natural Sciences of Philadelphia some valuable fossils; for instance, bones and casts of *Megalonyx Jeffersonii, Dinornis giganteus, Iguanodon, Plesiosaurus*, etc.

Mineralogy has been enriched by contributions from Drs. McPheeters, Pope, J. Koch, James G. Soulard, Esq., J. Harrison, Esq., Dr. Cavanaugh (Santa Fé), and Maj. Clark.

Malacology. The Rev. T. H. Newton presented us specimens from Panama and the West Indies. Dr. M. M. Pallen also made some additions.

The number of our Associate Members is at present about 150, but as many of them do not pay promptly, and the expense of our last publication amounted to a considerable sum, we are actually, as will appear from the Treasurer's Report, indebted for about three hundred dollars, which sum has to be paid from the next semi-annual dues of the members. These dues and voluntary contributions from members form at present our only financial resources, and as they are limited we must necessarily for the coming year confine our operations within those bounds. With larger means, it is true, a great deal more might be accomplished here in the centre of the Mississippi Valley, in the cultivation of the natural sciences, in developing the natural resources of the Great West, and in stimulating young men to habits of observing the wonders and studying the laws of Nature, which must result in the increase of human knowledge and the improvement of mankind. But even with our small means we will try to approach at least this high and noble end. Let us, therefore, not relax in our zeal, but work steadily on in the cause of science; and from small beginnings our Academy may grow to such importance in coming years, that not only St. Louis but the entire West will appreciate and upold it.

A. WISLIZENUS, *President.*

The Reports of the Corresponding Secretary and the Treasurer for the year 1859 were read, examined, and accepted.

The following gentlemen were elected officers of the Academy for the ensuing year, 1860:

President,	Hiram A. Prout.
1st Vice President,	George Engelmann.
2d Vice President,	Charles A. Pope.
Corresponding Secretary,	Nathaniel Holmes.
Recording Secretary,	Montrose A. Pallen.
Treasurer,	J. S. B. Alleyne.
Librarian,	G. H. E. Baumgarten.
Curators,	T. C. Hilgard, Edwin Harrison, C. W. Stevens, G. H. E. Baumgarten.
Com. on Publication,	N. Holmes, Wm. M. McPheeters, Geo. Engelmann.
Com. on Library,	C. A. Pope, Samuel Reber, G. H. E. Baumgarten.
Com. on Finance,	Spencer Smith, J. B. Eads, Chas. C. Whittelsey.

Chairmen of the Standing Committees were appointed as follows, viz:

Ethnology,	N. Holmes.
Comp. Anatomy,	C. A. Pope.
Embryology,	J. S. B. Alleyne.
Mammalogy,	C. W. Stevens.
Ornithology,	M. Lewis Clark.
Herpetology and *Ichthyology,*	F. E. Baumgarten.
Entomology,	W. M. McPheeters.
Botany,	Geo. Engelmann.

Palæontology and Geology,	H. A. Prout.
Mineralogy,	A. C. Koch.
Chemistry,	A. Litton.
Meteorology,	A. Wislizenus.

Newton D. Strong, Esq., was elected an Associate Member. Messrs. Sidney S. Lyon of Jeffersonville, Ind., and C. A. White of Burlington, Iowa, were elected Corresponding Members.

January 16, 1860.

Vice-President Dr. ENGELMANN in the chair.

Fifteen members present.

Letters were read from P. W. Mosblech, Bethany, Va., C. A. White, Burlington, Iowa, and Sidney S. Lyon, Jeffersonville, Ind., severally acknowledging their election as Corresponding Members.

A circular letter from the Royal Prussian Academy of Sciences of Berlin, enclosing a Circular of the Committee of the Humboldt Foundation, an institution proposed to be established at Berlin, in Prussia, for the encouragement of the Natural Sciences and travel, and named in honor of the memory of Alexander von Humboldt, was read and the subject thereof laid before the Academy; whereupon the following resolution was proposed and adopted:

Whereas this Academy is not itself, at the present time, in a condition to warrant an appropriation of any part of its funds to this useful and noble object, but would, nevertheless, gladly become the medium of transmission of such funds as may be contributed by individual members, or other citizens of St. Louis and vicinity, in furtherance of the high purposes of the Humboldt Foundation, it is

Resolved, That the Secretary be instructed to request the Daily Newspapers of the city, both English and German, to publish the letter and circular, received from the Royal Academy of Sciences of Berlin, and that the Treasurer of the Academy be authorized to receive any contributions which may be offered for this purpose, and to undertake the safe transmission of the same to the Treasurer of the Humboldt Foundation at Berlin.

The following publications were received: N. O. Med & Surg. Jour., Jan., 1860, *from the Editors;* Bulletin de la Soc. Imp. zool. d'Acclimatation, Nov., 1859, No. 11, *from the Society.*

Dr. Engelmann read a paper containing a report of his Meterological Observations, at St. Louis, for the year 1859.

On motion, the Secretary was requested to have an abstract presented to the daily papers for publication, and the accompanying table was ordered to be published in the Transactions.

Dr. Engelmann found the mean barometrical elevation 29.584 inches, very nearly the average elevation of St. Louis. The extremes were greater than usual—the highest elevation (January 22d) 30.304, and the greatest depression (March 28th) 28.516 inches, showing a range of 1.788 inches, while, generally, it does not amount to more than 1 or 1¼ inches.

The thermometrical observations—the most interesting for the public, and the most important for a knowledge of the climate—gave also exactly the average mean, 55°.4 Fahrenheit. The temperature during the different months was mostly also an average one; February, March and November were rather warmer, and April cooler, than these months ordinarily are. The most remarkable feature in the thermometrical condition of the year was the very low temperature of December, with 25° lower than he had ever observed it in that month within the last twenty-seven years. The mean temperature of January was only in three instances found lower, viz., in 1834, 20°, in 1856, 20°, and in 1857, 19°; and that of February was also, three times, as low or lower, viz., in 1835, 21°, in 1838, 20°, and in 1843, 25°. The lowest mean temperature for December, ever before observed by him, occurred in 1838 and in 1845—in both years amounting to 27°.4. The coldest day in the month and year was December 7th, with 3°.5 below zero.

We trace these great atmospheric waves, characterized by a sudden rise of barometer and fall of thermometer, from the Rocky Mountains to the Atlantic coast, and here on the Mississippi we are pretty nearly midway between these points. The data occasionally obtained from the eastern base of the Rocky Mountains (Fort Laramie, Pike's Peak) show that there the change usually takes place twenty-four hours sooner than it reaches us here, and twenty-four hours later it reaches the Eastern and Northeastern States. In Texas these changes seem to take place nearly at the same time as here, and they often extend far South into the tropics, where, in Mexico, they are known as "northers." The lowest temperature noted at Denver City, in the Pike's Peak region, occurred during the day (not in the morning) of December 5th, with 39° below zero. At New Braunfels, near San Antonio, in Texas, it reached 15° above zero on December 7th, and on the same morning it fell here to 3½° below, as above stated. December 8th was the coldest day on the Eastern coast. December 7th was the coldest day here since January 18, 1857, when the temperature fell to 12°.5 below zero; in the two intervening winters the thermometer fell to zero and to 1° below zero.

A glance at his meteorological tables revealed another interesting fact: scarcely ever more than one month in each winter shows a mean temperature below 30°. The only exception he found in twenty-five years, occurred in the winter of 1855–6, when January had a mean temperature of 19.3 and February of 26°.6. The mean temperature of the winter, (embracing the three months of December, January and February,) on an average 33°.6, was under 30° only in 1834–5, and in 1855–6.

Dr. Engelmann urged that observations instituted in the heart of a large city give a very incomplete insight into the climate of a country. They should be made simultaneously in the country, in low and in high situations; nor should the temperature in the sun and that of the soil be overlooked, which are scarcely ever observed. He stated that he happened to have the means, not to fill this great desideratum, but to show how different results are obtained by observations in different localities. Mr. A. Fendler has continued his observations—once made on the highlands of New Mexico, in the lowlands of Chagres, and on the mountains of Venezuela—here, in our neighborhood, in the valley of Rock Spring creek, not far from the Pacific Railroad machine shop. His average for the whole year shows 1°.4 less than the city. It is that much warmer in the high and dry and somewhat sheltered city locality, than in the rather low valley. The difference at 9 o'clock P. M. was the greatest, viz., 2°.1; at 2 P. M. it amounted to only 0°.3, and at 7 A. M. it was 1°.8. In the cooler months, from November to April, the average temperature in the valley was one degree, or even less, lower than in the city; in the warmer months the difference was considerably greater, and in August, October and July it amounted to respectively 2°, 2°.2 and 2°.4. These three months were also those in which the sky was clearest. The average of cloudiness for the year was 4.5 (entire cloudiness being indicated by 10); in August it was only 3.3, in October 2.8, and in July 2.6. It is therefore evident that the greater clearness of the sky and with it the greater evaporation and radiation produced the greater fall of the thermometer in that valley, as well as, no doubt, in all similar situations. The same fact is evident from the observation, that in cloudy weather there was little, if any, difference between the temperature of both localities, while this difference was greatest in clear and calm weather; on some days it amounted to 9 or 10 degrees; on the cold December day, repeatedly spoken of, Mr. Fendler's thermometer marked 11°, 7°.5 lower than Dr. Engelmann's.

Another instance of different results obtained by observations made at those different stations, is found in the dates of the latest spring and earliest fall frosts. Dr. E.'s thermometer fell to or below the freezing point for the last time in spring, April 6th; and for the first time in fall, October 28th, 205 days later. Mr. Fendler's thermometer indicated April 23d and October 9th as the dates of the latest and earliest frost, with only 169 days between them—a difference of 36 days. In elevated and drier situations in the country the result would probably be an intermediate one.

The clearness of sky was last year beyond the average. The clearest months were, as above stated, July, October and August; the cloudiest, December and March (5.5 and 5.6).

With all this clearness the quantity of rain and snow was considerably above an average one, amounting to over 61 inches (scarcely 9 inches less than in the excessively wet year 1858), only 3 inches of which fell as snow. The driest months were October (1.80), January and August; the wettest, June (11.02 inches).

Westerly winds prevailed, as usual, in the colder, and south-easterly in the warmer months of last year.

Dr. Engelmann also exhibited a table for the average temperature of every month in the last twenty-five years, and promised to continue such extracts from his meteorological journals, kept now for more than a quarter of a century.

Col. W. Gilpin presented to the Academy a Hydrographic Map of N. America, a Map of the Basin of the Mississippi, and an Isothermal Chart, constructed and drawn by himself, and made some explanatory remarks touching his views of the matters represented therein.

February 6, 1860.

The President, Dr. H. A. Prout, in the chair.

Eleven members present.

Letters were read from the K. bayer. Akad. d. Wissensch., Munich, Oct. 10, 1859; K. Danske Vidensk. Selskab, Copenhagen, July 1, 1859; Soc. Imp. des Naturalistes, Moscow, Jun. 22, 1859; Naturf. Gesellsch. zu Freiburg i. B., Oct. 20, 1859; severally acknowledging receipt of the Transactions and advising the Academy of the transmission of publications: also, a letter from the Hist. Society of Santa Fé.

Donations to the Library were announced as follows: Proc. Amer. Phil. Soc., Philad., July–Dec., 1859, *from the Society;* St. Joseph Jour. of Med. & Surgery for Sept., 1859, *from the Editors;* Program der Realschule zu Weisse, von Dr. Lundhaus, 1859, *from W. Sharswood;* Jour. Frank. Inst., Phil., Jan., 1860, *from the Institute;* Rep. of the Geol. & Agricul. Sur. of Texas, 1859, by B. F. Shumard, M.D., State Geologist, *from the Author;* Proc. Acad. Nat. Sciences, Philad., *from the Academy;* K. Danske Vidensk. Selskab Skrifter, V. Band, 1–2 Heft,—Oversigt, 1 Aaret 1858, *from the Society;* Industrie u. Gewerbe Verein—Konstruktions-Lehre von J. von Aschauer, mit 14 Figuren, Steiermark, *from the Society;* Jahresb. der Handels u. Gewerbekammer, 1852, Linz, —Darstellung der Stabeisen u. Rohstahl-Bereitung, von Peter Tunner, I.–VII. Heft, Gratz, 1845–6, *from the Society;* XXV. Jahresb. des Mannheimer Vereins für Naturk., 1859, *from the Society;* Gedenkblatt für Alex. von Humboldt, von H. Trautschold, Moskau, 1859, *from Dr. A. Senoner, Vienna;* Atti dell' I. R. Istituto Veneto, Tomo IV. Ser. iii, Disp. 8, 1858–9, *from the Institution;* Verhandl. der Naturf. Gesellsch. in Basel, II. Theil. 2–3 Heft, 1859, *from the Society;* Vehandl. der naturf. Gesellsch. zu Freiburg i. B. II. Band, 1 Heft, 1859, *from the Society;* Canad. Jour. Ind. Sci. & Art, Jan. 1860, *from the Canadian Institute.*

The Corresponding Secretary read some extracts from a letter addressed to him by Dr. B. F. Shumard, dated Austin, Jan. 5, 1860, giving intelligence of the progress of his investigations upon an interesting series of fossils from beds lying at the base of the Cretaceous group on Red River, in Northern Texas, and corresponding with No. 1 of the Nebraska section of Messrs. Meek and Hayden; in which the writer, also, further observes as follows:

"We frequently find in Texas, subjacent to the Bluff, a bed of rounded silicious boulders, sometimes resting on the Cretaceous and sometimes on the supposed Jurassic, and we have examined very carefully for organic remains both in the boulder deposits and in the overlying Bluff. We have not as yet found any fossils in the former; but in the latter fresh-water and land shells are of common occurrence, and at some points we have found bones of ruminants and fossil wood."

A large box of minerals and fossils collected by Mr. H. Engelmann, Geologist of the U. S. Expedition to the Rocky Mountains, in 1856, under Lieut. F. T. Bryan, U. S. A., was presented to the Academy in the name of Lieut. Bryan; and the thanks of the Academy were voted to Lieut. Bryan for his valuable donation.

Frederick von Hagenow, M.D., of Greifswald, Prussia, was elected a Corresponding Member.

February 20, 1860.

The President, Dr. H. A. Prout, in the chair.

Six members present.

A letter was read from the Librarian of the British Museum, London, Dec. 20, 1859, acknowledging the receipt of the Transactions of the Academy; also, a letter from George A. Stone, Boston, Feb. 6, 1860.

Donations to the Library were received as follows: Trans. Roy. Scottish Soc. of Arts, Vol. V., part iii., Edinb., 1860, *from the Society;* Bulletin mens. de la Soc. Imp. zool. d' Acclimatation, Tome VI., 12, Dec., 1859, *from the Society;* Jour. Frank. Inst., Philad., Feb., 1860, *from the Institute;* 12th Ann. Rep. Mercantile Library, Pittsburg, 1860, *from the Association;* Proc. Boston Soc. Nat Hist., Vol. VII., Dec., 1859,--Jan., 1860, *from the Society;* Memoir & Map of the Ter. of the U. S. from the Mississippi to the Pacific Ocean, by Lieut. G. K. Warren, Top. Eng., Wash., 4to, 1859, *from the Author;* Bookseller's Medium, by O. A. Roorbach, N. York, 1860, *from the Editor;* 4th Ann. Report Chicago Reform School, 1859, *from the Chicago Hist. Society;* Rep. of Corresp. & Papers of the Syro-Egyptian Soc., London, 1858--9, *from the Society.*

The committee to whom was referred the paper of Mr. A. H. Worthen, entitled "Notice of a new species of Platycrinus and other fossils from the Mt. Limestone of Illinois and Iowa, being an extract from the 2nd Annual Report of the Illinois Geological Survey," reported the same, with the accompanying drawings for a plate, for publication in the Transactions.

The committee also recommended the following abstract of Mr. Worthen's "Review of some points in Dr. B. F. Shumard's Report on the Geology of Ste. Geneviève County, Mo., for insertion in the Journal of Proceedings, viz:

"Mr. Worthen considers the 2nd Archimedes or Ste. Geneviève Limestone of Dr. Shumard (see Trans. Acad. of Sci., St. Louis, p. 406) as nothing but a part of the St. Louis Limestone, to which fossils of the Warsaw Limestone have been erroneously referred. In the first Illinois locality (Prairie du Rocher) mentioned by Dr. S. in the note to p. 406, Mr. W. finds the entire bluff just back of the village to be formed of St. Louis Limestone, characterized among other fossils by numerous specimens of *Lithostrotion mammillare,* even to within ten feet of its junction with the

Ferruginous Sandstone which, a mile and a half below the village, caps the Limestone, and further south forms the entire bluff for several miles.

Above the village the capping Sandstone has disappeared, but at the base of the bluffs the Warsaw Limestone crops out containing all the fossils enumerated by Dr. S. in the note quoted above, with the exception of *Productus elegans*, Nor. & Prat., which Mr. W. has never seen but in the Upper Archimedes or Chester Limestone.

The second locality, mentioned by Dr. S. in the note referred to as exhibiting his Ste. Geneviève Limestone, is the bluffs below the mouth of Mary's River, where he speaks of it as being characterized by *Pentremites obesus* and capped by 80 feet of Ferruginous Sandstone, shows, according to Mr. W., nothing but the Upper Archimedes or Chester Limestone overlaid by the sandstone of the Millstone-grit series; the Ferruginous Sandstone and the Limestone under it are far beneath the level of the river bottom.

According to Mr. W.'s observations, the Warsaw Limestone disappears under the surface above Prairie du Rocher; at that place, the St. Louis Limestone forms the entire bluff, and disappears under the surface about a mile and a half lower down; the Ferruginous Sandstone is then the only rock seen for about four miles further, when the Chester Limestone takes its place, and, together with the overlying sandstone of the Millstone-grit series, forms the bluffs along the Kaskaskia and Mississippi rivers down to the south line of Randolph county.

The following section of these rocks was made in the bluff about midway between the mouth of Mary's River and Liberty:

Massive and shaly sandstone with fossil plants, *Calamites*, *Lepidodendron*, *Sigillaria*, etc.	80 feet.
Upper Chester Limestone, with *Pentremites obesus*, *Archimedes*, *Athyris subquadrata*, *A. sublamellosa*, *Retzia vera*, *Spirifer increbescens*, *Allorisma*, and *Pinna*	40 "
Argillaceous shales and shaly sandstone, with terrestrial plants, plates of limestone with Fish teeth and Marine shells—the plant-bearing bed of the Mountain Limestone series	75 "
Lower Chester Limestone with *Pentremites Cherokeeus*, *P. cervinus*, *P. symmetricus*, *Productus elegans*, *Agassizocrinus* (2 or 3 species), *Spirifer spinosus*, *S. Leidyi*, *S. setigerus*, *Retzia costata*, etc.	50 "

The Corresponding Secretary presented, in the name of Capt. John Pope, U. S. A., a collection of Bird-skins, from the Smithsonian Institution, collected by Capt. Pope, in Texas and New Mexico, and labelled and numbered according to the Smithsonian Catalogue, by Prof. S. F. Baird, as follows, viz: 5027, *Tinnunculus sparverius;* 10301, *Corvus cryptoleucus;* 84, 5038, *Athene hypogaceæ;* 5024, 4349, 9133, 152, not named.

Dr. Engelmann presented, in the name of Dr. I. Forbes, the head of a new-born lamb, showing a remarkable instance of monstrosity in the development of the head and neck.

Dr. C. W. Stevens, who had examined the case, remarked:

That, on a careful inspection, he found there was apparently an absence of the lower maxilla; a displacement of the auricular appendages to the sides of the neck, about one inch below the normal location; and a circular opening in the neck, of about three fourths of an inch in diameter. A fissure or slit of about one inch in length appeared in the skin beneath the upper jaw; this fissure was bounded above by the palate; from the fissure a probe passed to a cul de sac, common to this vestige of a mouth and the posterior nares. A circular opening in the neck was found to be leading both to the œsophagus and the trachea; there was no passage to the fissure before mentioned. Within this orifice the hyoid bone was found. No external meatus of the ear could be discovered. The animal, as we were informed, was born alive, and breathed through the opening in the neck, but died, a day or two afterwards, from inability to obtain nourishment.

Mr. E. A. Filley presented a polished block of gypsum, from the strata immediately overlying the rocks in which are found the Salt Springs, near Grand Rapids, in Michigan.

March 5, 1860.

The President, Dr. Prout, in the chair.

Eleven members present.

A letter was read from Dr. A. Schlottmann, of Roundtop, Texas, proposing to send to the Academy a paper on "Aphorisms on Natural Sciences."

The committee to whom was referred the paper of Ed. Miller, C. E., "On the Methods of obtaining Water for Railroad purposes on the high prairies of Missouri," reported the same for publication.

Dr. H. A. Prout read a paper entitled "Descriptions of new species of Bryozoa from the Palæozic Rocks of the Western States and Territories, 4th series." Referred to the Committee on Publication.

Dr. M. A. Pallen presented an Ammonite from El Paso, New Mexico.

March 19, 1860.

Vice-President Dr. Engelmann in the chair.

Eleven members present.

Donations to the Library were announced as follows: Proc. Acad. Nat. Sci., Phil., Jan. 1860, *from the Academy;* School Law of Illinois, 1859,—Baptist Anniversaries, 1859, *from the Chicago Hist. Society;* Jour. of Education, Dec., 1859, *from Capt. L. A. Huguet-Latour;* Ballière's Catalogue, N. York, 1860, *from the Publishers;* Amer. Jour. Sci. & Art, New Haven, March, 1860; N. O. Med. & Surg. Jour., March, 1860, *from the Editors;* Jour. Frank. Inst., Phil., Mar., 1860, *from the Institute;* Canad. Jour. of Ind. Sci. & Art, March, 1860, *from the Canadian Institute;* Bulletin mens. de la Soc. Imp.

zool. d'Acclimatation, Jan. '60, *from the Society;* Beiträge zur Kenntniss der Spaltöffnungen,—Ueber ein neues Vorkommen, &c.,—Untersuchungen über der Zusammenhang, &c.,—Studien aus der Natur, &c., von Dr. Adolph Weiss, Wien, 1858, *from the Author.*

Dr. T. C. Hilgard entered upon an elaborate discussion of the original and actual present signification of the empirical term "Species."

April 2, 1860.

Dr. H. A. Prout, President, in the Chair.

Eight members present.

Letters were read from Prof. Joseph Henry, Washington, Jan. 10, 1860, and from Prof. S. F. Baird, Washington, Jan. 12, 1860, acknowledging receipt of the Transactions of the Academy.

The following publications were received: Proc. Boston Soc. Nat. Hist., Feb.–March, 1860, *from the Society;* Proc. Acad. Nat. Sciences, Philad., Feb., 1860,—Journal of the same, Vol. IV., part iii., 4to, Philad., 1860, *from the Society;* Notice of Remains of Walrus,—Remarks on Saurocephalus and its allies,—Descr. of Remains of Fishes, from the Carboniferous Limestone of Illinois and Mo.,—Observations on the extinct Peccary, and Remarks on the structure of the feet of the Megalonyx,—by Joseph Leidy, M.D. (Extrs. from the Trans. Amer. Phil. Soc., Vol. XI., Philad.), *from the Author;* Prodromus descriptionis animal. evertebratorum, quæ, et cet., observavit et descripsit W. Stimpson, Pars VIII. (Proc. Acad. Nat. Sciences, Philad., Jan., 1860), *from the Author.*

Dr. H. A. Prout exhibited a fossil tooth found at King's Salt Works, near Abingdon, Va.

Dr. P. remarked, that he had the pleasure of presenting before the Academy, to-night, the fragment of a large molar tooth, a fossil remain of a newly discovered form of animal life, most probably belonging to the Eocene period, and contemporaneous with the Palæotherium, the Anoplotherium, and the Lophiodon.

Although it was difficult from the mere fragment of a tooth to define its general outlines, and the zoölogical relations of the animal to which it belonged, he believed that in the specimen before him he could safely assert, that it did not belong to any of the forms of gigantic fossil teeth previously described. Judging from its structure, it was very evident that it bore a close analogy to the *Titanotherium Proutii,* Leidy, a palæotheroid animal which he described in Silliman's Journal for 1846, and the discovery of which led to the opening up to the scientific world the immense and rich repositories of organic remains in the Territory of Nebraska. The lobed or indented border of the enamel would seem to show that this animal was nearly allied to the Titanotherium, while the great width and depth of the groove between the outer and what may have been the inner border of the tooth would separate it from this genus. He knew of no tooth belonging to these gigantic races of a former world which approaches it in the extent of this deep expansive concavity between the outer and inner cutting edges of the enamel save the Lophiodon, and he felt satisfied, on comparing it with the plates representing the teeth of the latter, that it was a distinct genus. It is distinguished moreover from these by the greater length of the fangs and the comparative shortness of the enamel on the outer surface of the tooth. It may have formed a connecting link between the Palæotheroid animals and the Lophiodon, possibly having some characters belonging to each of them, though generically distinct. It must have been a phytiverous pachyderm, as large if not larger than the Titanotherium.

He took great pleasure in proposing to designate it, at least provisionally, by the generic name of *Leidyotherium*, in honor of Prof. Jos. Leidy, whose distinguished labor in comparative anatomy has already accomplished so much in illustrating the fossil mammalia of a former world.

This specimen was sent to him by his friend Dr. S. Horine, of Knoxville, Tennessee, and was found at King's Salt Works, near Abingdon, in Virginia, where he hoped the scientific world might find another catacomb as populous and as interesting as those of the Mauvaises Terres. He had written to his friend to procure other specimens, if possible, and trusted he should be able to present the Academy with something more definite upon the character of these remains within a few weeks.

Mr. N. Holmes presented a fragment of Indian pottery, made of sun-dried clay, which he had obtained from the Big Mound at St. Louis.

He remarked that the streets in the vicinity of the mound had been cut down to a depth of eight or ten feet below the natural surface, and that the northern and western portions of the mound had been excavated away to the depth of the streets, making a section of the mound on those sides. In this section, the line of level of the natural surface, as he had frequently observed, was distinctly marked through the entire base of the mound and of the terrace on the eastern side. Below the surface level, the lines of stratification as of deposits out of water were very evident; above it, the section presented a nearly uniform appearance and almost homogeneous structure, with only here and there some patches of lighter or darker shades of color. The color in general of the upper portion was grayish, indicating vegetable or surface soil; that below the original surface was yellowish like the clay of our hills. He had found this fragment of pottery imbedded in the upper and artificial portion of the section, about two feet above the natural surface line, on the western side.

It was highly improbable that this pottery could have been drifted to that position, on the supposition that the mound was a natural formation. The conclusion was inevitable, that it must have been carried thither by the Indians mixed with the materials of which they were constructing the mound; and it may be safely taken as an additional proof of the artificial character of the structure; if, indeed, any other evidence of that fact were required than what is afforded by the appearance of the section alone.

Mr. Schoolcraft, some years ago, and Dr. Koch, more lately, had supposed this mound to be a natural formation. Messrs. Squier and Davis, before the section was made, judging from its situation and form, its single terrace on the eastern side, and other circumstances no less significant, especially when compared with other similar structures (of which Monk's Mound in the American Bottom was an example), had entertained no doubt of its artificial character; and they regarded it as belonging to the class of Temple Mounds, resembling the Teocallis of Mexico, and as having been used for purposes of superstitious worship. That the views of

Messrs. Squier and Davis were correct, there could be no reasonable doubt.

Dr. Prout presented, in the name of Mr. C. A. White of Burlington, Iowa, several species of fossils, some of them new, from the Chemung group of the Devonian at Burlington, viz: *Nucleospira Barrisii*, *Chonetes Logani*, *Productus arcuatus*, *P. Shumardianus*, *P. levicostus*, *Rhynchonella pustulosa*, *Orthis Thiemii*, *Athyris crassicardinalis*, and *Onychocrinus exculptus*.

Wm. J. Sloan, M.D., Surgeon U. S. A., Corresponding Secretary of the Historical Society of Santa Fé, was elected a Corresponding Member.

May 7, 1860.

Vice-President Dr. ENGELMANN in the chair.

Thirteen members present.

Letters were read from the Naturf. Verein, Riga; Verein für vaterländ. Naturf. in Württemberg, Stuttgart; Pharmaceutical Society, St. Louis,—severally acknowledging the receipt of the Transactions of the Academy.

Donations to the Library were announced as follows: Bulletin de la Soc. Imp. zool. d'Acclim., Paris, Tome VII. 2, Feb., 1860, & 3, March, 1860, *from the Society*; Centralblatt von der K. K. patriot. ökon. Gesellsch. im Königreiche Böhmen, Prag, 1858,—Generalbericht, 1858–9, *from the Society*; Atti dell' I. R. Istituto Veneto, Tomo IV., Ser. iii., Disp. 9–10, *from the Institution*; Gelehrte Anzeigen der K. bayer. Akad. der Wissench., Band 47–48, 1858–9, 4to,—Almanach, 1859,—Erinnerung an Mitglieder der math.-phys.-Classe, von Carl F. P. von Martius, 1859,—Erinnerung an Johan Georg von Lori, *from the Royal Academy*; Verhandl. u. Mittheil. des Vereins für Naturw. zu Hermannstadt, IX. Jahrg. 1859, X. Jahrg. 1–6, 1859, *from the Society*; Bericht des naturw. Vereins des Harzes, 1846–9, 1851–4, 1857–8, *from the Society*; Denkschrift über die Gebrüder J. S. u. C. B. Presl,—Denkrede auf Prof. F. A. Petrina—Leben u. Wirken des Hern Dr. J. Th. Held,—Festschrift,—Verzeichniss der böhmischen Trilobiten, Prag, 1857,—Geograph. Breite von Prag, 1857,—Leibnitz u. Comenius, von Dr. F. V. Kvet, Prag, 1859,—Die Porphyre im Silurgebirge von Mittelböhmen, Prag, 1859,—*from Dr. W. R. Weitenweber*; Sitzgungsb. der. K. böhm. Gesell. der Wissensch. in Prag, Jahrg. 1859, Jan.–June, *from the Society*; Bull. de la Soc. Linnéenne de Normandie, Vol. IV., 1859, *from the Society*; Württemb. naturw. Jahreshefte, XVI. Jahrg., 1 Heft, Stuttgart, 1860, *from the Society*; Archiv des Vereins des Naturg. in Meklenburg, XIII. Jahrg, *from the Society;* Mittheil. aus dem Osterlande, Altenburg, Band XIV., 1856, *from the Society;* Wohnsitze der Brachiopoden von Prof. Edward Suess, Wien, 1859, *from the Author;* Entomol. Zeitung, Stettin, XX Jahrg. 1859, *from the Society;* Correspondenzblatt des Naturf. Vereins, Riga, X. Jahrg. 1858, *from the Society;* Jour. Frank. Institute, Philad., April, 1860, *from the Institute;* Proc. Acad. Nat. Sciences, Philad., March, 1860, *from the Academy;* Proc. California Acad. Nat. Sciences, 1858--9, *from the Academy;* Catalogue of Flora of Wis., by Hall & Lapham, 1860, *from the Authors.*

A paper presented for publication by B. F. Shumard, M.D., being a "Notice of Meteoric Iron from Texas," now deposited in the State Geological Cabinet at Austin, was read by the Corresponding Secretary. Referred to a committee.

A paper presented for publication by B. F. Shumard, M.D., State Geologist of the State of Texas, entitled "Descriptions of new Cretaceous Fossils from Texas," was read by the Corresponding Secretary. Referred to a committee.

On motion, it was ordered, that the Corresponding Secretary be authorized to cause a specimen of the mass of meteoric iron from Nebraska, now in the possession of the Academy, to be cut off and presented to Prof. C. U. Shepard of New Haven.

Dr. Pope presented a piece of lava from Mt. Vesuvius, having a copper coin of modern date embedded in it.

May 21, 1860.

Vice-President Dr. ENGELMANN in the chair.

Six members present.

A circular letter was read from the Smithsonian Institution, dated May, 1860, relating to the transmission of exchanges to Europe.

The Corresponding Secretary communicated the substance of a letter which had been addressed to him by Prof. W. Haidinger, Director of the Imperial Geological Institute of Vienna, dated the 20th April, 1860, requesting, for the Imperial Mineralogical Museum at Vienna, a specimen of the meteoric iron found in Nebraska Territory, and now deposited in the Museum of the Academy; and, also, containing a list of the additions which had been made to the Vienna catalogue of Meteorites (now the largest in the world) since the last publication of the same, as follows: *Stones*—Nov. 30, 1822, Allahabad; Nov. 30, 1850, Shalka in Bauwora; March 6, 1853, Soojoulee; May 13, 1855, Island of Oesel, Russia; June 7, S. Denis Westrem, Belgium; Aug. 5, Petersburgh, Lincoln Co., Tennessee; Dec. 9, 1858, Aussnu, France; discovered in 1846, Assam. *Irons*—Himalga, Chili, found in 1840; Kurrukpur near Monghir, found in 1848; Orange River, S. Africa, found in 1856.

On motion, it was ordered, that the Corresponding Secretary be authorized to cause a suitable specimen to be cut off from the mass and transmitted, through the Smithsonian Institution, to the Imperial Mineralogical Museum.

The following publications were received: N. O. Med. & Surg. Jour., May, 1860, *from the Editors;* Jour. Frank. Inst. Phil., May, 1860, *from the Institute;* 42d Ann. Rep. of the N. York State Library, 1860, *from the Trustees;* Silliman's Amer. Jour., May, 1860.

A paper presented for publication by B. F. Shumard, M.D., State Geologist of the State of Texas, entitled "Observations upon the Cretaceous Strata of Texas," was read by the Corresponding Secretary, and referred to a committee.

A paper presented for publication by Sidney S. Lyon, of Jeffersonville, Ind., entitled "Descriptions of four new species of Blastoidea, from the Subcarboniferous Rocks of Kentucky," illustrated by drawings for a plate, was read by the Corresponding Secretary. The paper and drawings were referred to a committee.

A paper offered for publication by Mr. S. S. Lyon, entitled "Stratigraphical Arrangement of the Rocks of Kentucky," accompanied with a figure of the section, was read by the Corresponding Secretary, and referred to a committee.

The committee to whom was referred the paper of Dr. B. F. Shumard, being "Descriptions of new Cretaceous Fossils from Texas," reported the same for publication in the Transactions.

The committee to whom was referred the paper of Dr. B. F. Shumard, entitled "A Notice of Meteoric Iron from Texas," recommended the same for publication.

Dr. G. H. E. Baumgarten presented a number of reptiles preserved in alcohol, consisting of turtles, frogs, and snakes, collected in the neighborhood of St. Louis.

June 4, 1860.

Vice-President Dr. ENGELMANN in the chair.

Eight members present.

A letter was read from Dr. W. J. Sloan, Santa Fé, N. Mex., acknowledging his election as a Corresponding Member.

Letters were read from the K. Akad. der Wissensch., Vienna, Dec. 17, 1859; Acad. Royale des Sciences, Stockholm, Nov. 25, 1859; Acad. Royale des Sciences, Amsterdam, Nov. 30, 1859; R. Akad. des Wissen., Vienna, July 7, 1859, and March 17, 1859; Verein für Naturk., Wiesbaden, Dec. 27, 1859; Naturk. Verein, Bonn, Feb. 2, 1860; Smithsonian Instit., Washington, May 20, 1860, — severally acknowledging the receipt of the Transactions of the Academy, and announcing the transmission of publications in exchange.

Donations to the Library were received as follows: Proc. Acad. Nat. Sciences, Philad., April, 1860, *from the Academy;* Sitzungsb. der K. Akad. der Wissensch. math.-naturw. Classe, 1858, No. 27–29; 1859, No. 1–20, Band xxxiii.–xxxvii, Wien, —Register der Sitzungsb., 21 bis 30, Wien, 1859,—Almanach, 1859, *from the Imperial Academy;* K. Svenska Vetensk. Akad. Handl. Ny Följd. 1, 1857,—Eugenies Resa, H. 6 Zoologi III., 1859,—Ofversigt, 1858, *from the Royal Academy of Stockholm;* Verhandl. (Afd. Naturk.) Deel VII. 4to, (Letterk.) Deel I. 4to,—Versl. Med. (Afd. Naturk.) Deel VIII.–IX. 8vo, (Afd. Letterk.) Deel IV.,—Yaarboek 1858–9, *from the Royal Academy of Amsterdam;* Aus der Heimath: ein naturw. Volksblatt, von E. A. Rössmässler, Glogau, 1859, *from the Editor;* Verein für Naturk. im Herzogthum Nassau, Jahrb. H. XIII.,—Athysanus-Arten von C. L, Kirschbaum, Wiesbaden, 1858, *from the Society;* Verhandl. des naturk. Vereins der preuss. Rheinl. u. Westphalens, XVI. Jahrg. 1–4 Heft, Bonn, 1859, *from the Society;* Bull. mensuel de la Soc. Imp. zool. d'Acclim'n, Tome VII., April, 1860, *from the Society;* Canad. Jour., May, 1860, *from the Canadian Institute.*

The committee to whom was referred the paper of Dr. B. F. Shumard entitled "Observations upon the Cretaceous Strata of Texas," reported the same for publication in the Transactions.

The committee to whom was referred the paper of Mr. S. S. Lyon, entitled "Descriptions of new species of Blastoidea, &c.," reported the same for publication; and it was ordered that the drawings for a plate to illustrate the same be placed in the hands of the lithographer.

The committee on the paper of Mr. S. S. Lyon, entitled "A Stratigraphical Arrangement of the Rocks of Kentucky," recommended the same for publication in the Transactions, together with a woodcut of the section.

Dr. Engelmann laid before the Academy the results of his meteorological observations during the past three months.

They *proved* what everybody and even the "oldest inhabitant" seems to have *felt*, that this Spring was one of the warmest and by far the driest one which has been experienced in St. Louis since a quarter of a century.

The mean temperature (the result of three daily observations, taken at 7 o'clock A. M., 2 o'clock P. M., and 9 o'clock P. M.) of March, was 49.8 deg. higher than the temperature of any other March in the last twenty-five years, with the exception of that of March, 1842, which rose even to 56.7 deg. The average temperature of March is 44.5 deg.

April showed a mean temperature of 59.0 deg., not fully 3 deg. over the average of this month (56.2 degrees). Eight times in the last twenty-five years April had been warmer than this season, and in 1844, the year of the great flood, it even rose to 66.7 deg.

May last was by far the warmest one Dr. E. ever observed here, its temperature amounting to 72.1 deg. The next warmest May occurred in 1846, with 69.3 degrees. The average for May had been found to be 66.0 degrees.

The average temperature of these three Spring months, amounting to 60.3 degrees, was equalled in the last twenty-five years once, in 1844, and surpassed once, in 1842, with 62.2 deg.

These two years, together with the present one, had the earliest Springs and showed the most rapid development of the vernal vegetation; while the years 1857 and 1843, with a mean temperature of Spring of respectively 48.6 and 49.9 deg., were the most backward in these respects in the last quarter of a century.

Another equally if not more important feature in the meteorological condition of last Spring is its excessive dryness.

The quantity of rain which fell in March amounted to 1.16 inches, while the average for March has been found to reach 3.41 inches. Only in the year 1853, with 0.75 inch, and 1856, with 1.06 inches, the drought in this month was greater.

In April, 2.03 inches of rain fell—exceeded only once, in 1857, with 1.72 inches. The average for April is 4.12 inches.

The quantity of rain in May was 2.27 inches; less than ever before observed. The average is 5.13 inches.

Thus, the amount of rain for those three Spring months was found to be only 5.46 inches, while the average reaches 12.66 inches. The next driest Springs observed were those of 1853, with 7.67, and 1849, with 8.05 inches of rain.

The excessive electrical phenomena which immediately followed the protracted period of heat and dryness, and which were exhibited so destructively, especially in the valley of the Ohio and of the Upper Mississippi Rivers, from May 20th to June 3d, were undoubtedly the necessary consequence of that abnormal state of the atmosphere. The most violent in the succession of these storms, with us, occurred from June 2d, at 6 o'clock P. M., to June 3d, at 6¼ A. M., pouring down 3.73 inches of rain.

The Corresponding Secretary was authorized to procure a lithographic plate to be executed of the mass of meteoric iron from Nebraska, to accompany the description and analysis of the same now in course of preparation.

June 18, 1860.

The President, Dr. H. A. Prout, in the chair.

Seven members present.

Letters were read from the Smithsonian Institution, Wash., June 4, 1860, announcing the transmission of packages, and from the K. Leopoldinisch-Carolinische Akad. der Naturf., Jena, Feb. 18, 1860, acknowledging the receipt of the Transactions of the Academy.

The following publications were received: Proc. Boston Soc. Nat. Hist., March--May, 1860, *from the Society;* Mém. de l'Académie Imp. de Sciences, Arts et Belles-Lettres de Dijon, Tome VII., Ser. 2, 1858--9, *from the Academy;* Mém. de l'Acad. Imperiale de Caen, 1860, *from the Academy;* List of Officers and Members of the I. R. Istituto Lombardo, Milan, May, 1860, *from the Institution;* Proc. Amer. Antiq. Soc., Boston, 1860, *from the Society;* Jour. Frank. Inst., Philad., June, 1860, *from the Institute.*

A paper offered for publication by B. F. Shumard, M.D., State Geologist of Texas, entitled "Descriptions of five new species of Gasteropoda from the Coal Measures and a Brachiopod from the Potsdam Sandstone of Texas," was read by the Corresponding Secretary, and referred to the Committee on Publication.

Dr. Pope presented two large cans containing snakes, and other reptiles, collected in the neighborhood of St. Louis.

July 2, 1860.

The President in the chair.

Five members present.

A letter was read from the Smithsonian Institution, announcing the transmission of Vol. XI. of the Smithsonian Contributions to Knowledge.

Donations to the Library were received as follows:—2d Ann. Rep. of the Chicago Charitable Eye & Ear Infirmary 1860, *from the Trustees;* Trans. Amer. Phil. Soc., Philad., Vol. XI., Parts I.--III., 1857--60, 4to,—Proc. of same, Vol. VII., No. 63, Jan.--June, 1860,—Laws & Regulations of same, 1860,—List of Members of same, 1860, *from the Society;* Smithsonian Contr. to Knowl., Vol. XI., 4to, 1859, *from the Institution;* Proc. Acad. Nat. Sciences, Phil., May, 1860, *from the Academy.*

A paper presented for publication by Prof. G. C. Swallow, State Geologist, entitled "Descriptions of New Fossils from the Carboniferous and Devonian Rocks of Missouri," was read by the Corresponding Secretary, and referred to the Committee on Publication.

Dr. Engelmann read a paper for publication, entitled "Notes on the Grape-vines of Missouri." Referred to the Committee on Publication.

Dr. Engelmann stated that Dr. Wislizenus had provided himself with Dellmann's apparatus for measuring atmospheric electricity, the most delicate and complete one ever constructed; and that he had entered upon a course of regular observations, about which he proposed in due time to report to the Academy. The only other apparatus of the kind in the United States has been lately imported by the Smithsonian Institution.

Dr. Engelmann further reported the results of his meterological observations during the month of June.

Its mean temperature reached 76.2 deg., two degrees more than the average for this month.

The quantity of rain amounted to 6.58 inches, a little over the average for June—quite sufficient, in a great measure, to redeem the crops, which had almost been given up for lost by our farmers and gardeners.

A remarkable series of destructive hurricanes, always accompanied by electrical explosions and very frequently by a heavy fall of hail, occurred in several parts of our valley between May 21st and June 13th. The most noted ones were those of the afternoon of May 21st at Cincinnati, of the morning of May 27th at Louisville, and especially that of the evening of June 3d in Iowa and northern Illinois.

The most violent storms which we experienced in St. Louis, during this period, occurred on the evening of May 26th (perhaps identical with the Louisville storm); on the evening of June 2d (about 20 hours before the Iowa storm); after midnight of June 12th, and in the afternoon of June 13th. The storm of June 2d was the most violent one, but none of them did much injury. In all these storms, the wind, after blowing for some time quite moderately from the east or south-east, suddenly veers round to the west or north-west, when it assumes its greatest violence; and then, after a few minutes, or at most a quarter of an hour, lulls and goes round to east again. This gyration is sometimes repeated once or twice during the same storm. The barometer, according to Dr. Engelmann's observations, is rarely much influenced by these phenomena, and does not seem to predict them at all; during the storm of June 2d it showed some fluctuation, but soon resumed its former state. Only storms which accompany a great and far-extending change of the weather are indicated by the barometer. A considerable and, usually, steadily progressing fall of the barometer is then observed, which with the commencement of the storm changes to a (sometimes quite sudden) rise; commonly this rise continues for some days afterwards, accompanied by a fall of the thermometer, westerly and north-westerly winds, and a clear and dry atmosphere.

July 16, 1860.

Vice-President Engelmann in the chair.

Seven members present.

The following publications were received: Proc. Boston Soc. Nat. Hist., June, 1860, *from the Society;* Bull. mensuel de la Soc. Imp. zoolog. d'Acclimatation, No. 5, May, 1860, *from the Society;* N. O. Med. & Surg. Jour., July, 1860, *from the Editors;* Jour. Frank. Inst., Phil., July, 1860, *from the Institute;*

Trans. Wisconsin State Agricul. Soc., 1858–9,—Trans. of the Hist. Soc. of Wisconsin, Vol. IV., 1857–8,—*from I. A. Lapham, Esq.*

Specimens of *Allorisma regularis* from the Pacific Railroad in St. Louis county, and *Spirigera differentia* from Belleville, Ills., were presented by Mr. H. W. Leffingwell.

Major M. L. Clark stated that, in the year 1836, a large meteor had been seen to fall, near the mouth of the Osage river in this State; that there was an explosion in the air, the report of which he had himself heard, at the time; and that upon inquiry, afterwards, he learned that a fragment of it had been dug from the ground by some persons in the neighborhood, which he understood to be iron; and he thought that, if proper inquiries were made, some trace of it could still be found there.

Dr. Sander observed that reports were current to the effect that gold had been discovered in the vicinity of the Iron Mountain, and called upon Prof. Swallow to state whether the Geological Survey had noted any thing of that kind.

Prof. Swallow stated that he had not, as yet, seen any traces of gold in that region, but could not say what other persons may have discovered. In some other parts of the State, he had found small particles of gold in the sands of the streams, but nowhere in such quantities as would pay for the washing.

Maj. Clark remarked that, many years ago, some tribes of Indians, then residing in the southwestern parts of Missouri, were in the habit of bringing gold dust to St. Louis to trade with the jewellers. He had himself seen it in the hands of these Indians; but whether or not it was obtained within the limits of the State, he could not say.

Edwin Leigh, M.D., was elected an Associate Member.

August 6, 1860.

The President in the chair.

Eight members present.

A letter from the Chicago Acad. of Science, dated the 31st July, 1860, was read; and, also, letters from the Physicalisch-med. Gesellsch. in Würzburg, April 4, 1860; Verein zur Beförd. des Gartenbaues, Berlin, April 6, 1860; Museum Francisco-Car., Linz, April 15, 1860; K. bayer. bot. Gesellsch. zu Regensburg, Feb. 20, 1860; Université Catholique de Louvain, Nov. 15, 1859; K. preuss. Akad. der Wissensch., Dec., 31, 1859; Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique, Bruxelles, Nov. 23, 1858; and from the "Pollichia," Deidesheim, May 22, 1860; severally acknowledging the receipt of the Transactions of the Academy and announcing the transmission of publications.

Donations to the Library were received as follows: Amer. Jour. Sci. & Art, July, 1860; Correspondenz-Blatt des zool.-mineral. Vereins in Regensburg, XIII. Jahrg., 1859, *from the Society;* Weinbauschule, Stuttgart, 1859,—Ueber *Tamus elephantipes*, Linn., v. Dr. von Jäger,—Ueberreste von Menschen u. Thieren, v. Dr. von Jäger,—Verhältniss der parasitischen Gewächse zu den Nährpflanzen, v. Dr. von Jäger,—*from the Author;* Würzburger medicinische Zeitschrift, I. Band, 1 Heft, 1860,—Sitzungsb. der phys.-med. Gesellsch., 1859; *from the Society;* Verhandl. der Vereins zur Beförd. des Gartenbaues, VII. Jahrg. 2 Heft, Berlin, 1860,—Wochenschrift, redigirt v. Prof. Dr. Karl Koch, No. 1–13, 1860, *from the Society;* Inselbildung durch Korallen u. Mangrovebüsche, von Dr. D. F. Weinland, Stuttgart, 1860, *from the Author;* Berichte über die Verhandl. der naturf. Gesellsch. zu Freiburg i. B., Band II. Heft 2, 1860, *from the Society;* XIX. Bericht über das Museum Francisco-Car., Linz, 1859,—Geognostiche Wanderungen im Gebiete der nordöstl. Alpen, von Carl Ehrlich, Linz, 1854, *from the Institution;* Zoologische Garten, I. Jahrg. Heft 1–6, von Dr. D. F. Weinland, Frankfurt-a.-M., 1860, *from the Editor;* Sitzungsb. der K. Akad. der Wissensch., Wien, Band XXXVII., Nos. 21–22, Band XXXVIII., Nos. 23–28, Band XXXIX., No. 1–2, math.-naturw. Classe, 1859–60, *from the Imperial Academy;* Denkschriften der K. bayer. bot. Gesellsch. zu Regensburg, IV. Band 1 Abth. 4to, 1859,—Flora, XVII. Jahrg., 1859,—*from the Society;* Annuaire de l' Université Cath. de Louvain, 1855–9, 5 Vols. 12mo,—Programme des Cours, 1855–6 à 1859–60,—Theses fac. theol. 181–231 (216 vacat),—Theses fac. med. 41–50 (44 vacat),—Theses fac. phil. 8–12,—Theses fac. S. 2–4,—*from the University;* Monatsb. der K. preuss. Akad. der Wissensch., Jan.-Dec., 1859, Berlin,—Abhandl. 1854, 2nd Suppl.-Band, 4to, Berlin, 1859, *from the Royal Academy;* Méms. de l'Acad. Imp. des Sciences de St. Petersbourg, VII. Ser., T. I., No. 1–15, 4to, 1859,—Bulletin, T. I. (1–6 Feuilles), *from the Imperial Academy;* Bulletin de l'Acad. Royale des Sciences, des Lettres et des Beaux-Arts de Belgique, Tome IV.–V., 1858, VI., 1859, 8vo, Brux.,—Tables générales et analytiques du Recueil des Bull., Tome I.–XXIII., 1832–56, 8vo, Brux. 1858,—Annuaire, 1859,—Collection de Chroniques Belges inedités, T. III., 2me Partie, Glossaire par M. Em. Gachet, Chef du Bureau Paléographique, 4to, Brux., 1859,—Météorologie et Astronomie par M. A. Quetelet,—Eclipse de Soleil du 15 Mars, 1858, par M. Ad. Quetelet,—Géodésie-

Magnetisme, par M. Encke,—Note sur l'Aurore Boréale du 21 Avril, 1859, par M. Ernest Quetelet,—*from the Royal Academy;* Bull. de la Soc. Imp. zool. d'Acclimatation, Juin, 1860, *from the Society;* Bulletin Biographique de Hector Bossange et Fils, Juillet, 1860; Proc. Acad. Nat. Sciences, Phil., June, 1860, *from the Academy;* Cat. of described Lepidoptera of N. Amer., by John G. Morris, 8vo, Wash., 1860,—Check Lists of the Shells of N. Amer., by Isaac Lea, P. P. Carpenter, Wm. Stimpson, and Temple Prime, 8vo, Wash., 1860, *from the Smithsonian Institution;* Canadian Jour. Sci. & Art, July, 1860, *from the Editors;* Jour. Frank. Inst. Phil., Aug., 1860, *from the Institute;* Jahresb. der Pollichia, eines naturw. Vereins der Rheinpfalz, Band XV.--XVII., 1857--9, —Commentationes Botanicæ, auct. fratribus Schultz, 1859,—Die Laubmoose der Rheinpfalz, *from Dr. Schultz.*

Dr. Engelmann observed that Saturday, July 21st, ult., was the hottest day he had ever observed at this locality, the thermometer (Fahr.) indicating 104° in the shade; in some localities in the city, it ranged as high as 106° and 107°; a strong southwest wind was blowing at the time, gradually veering to the west and northwest without any abatement in the temperature. The air was excessively dry, the wet bulb thermometer ranging nearly 30 degrees lower than the dry bulb, which indicates a proportion of humidity in the atmosphere of only about 22.

Prof. William Haidinger, Director of the Imperial Geological Institute of Vienna, &c., &c., Prof. Charles U. Shepard of New Haven, Conn., Solomon Horine, M.D., of Memphis, Tenn., and C. H. Schultz, M.D., of Deidesheim, Bavaria, were elected Corresponding Members.

August 20, 1860.

Vice-President Dr. Engelmann in the chair.

Five members present.

A letter was read from Prof. C. U. Shepard, Aug. 15, 1860, acknowledging his election as a Corresponding Member.

The following publications were announced: Proc. Acad. Nat. Sciences, Philad., July, 1860, *from the Academy;* Proc. Boston Soc. Nat. Hist., July & Aug., 1860, *from the Society;* Bull. mensuel de la Soc. Imp. zool. d'Acclimatation, Paris, T. VII., No. 7, Juillet, 1860, *from the Society.*

A letter was read from Dr. M. A. Pallen, communicating his resignation of the office of Recording Secretary, which was accepted; and an election was ordered for the next meeting to fill the vacancy.

Mr. N. Holmes stated, that the lithographic plate which had been ordered, at a previous meeting, to represent the mass of Meteoric Iron found in Nebraska Ter. and mentioned in the Transactions of the Academy (p. 307), had been executed. It gives a very good representation of the object.

The only data, historical or descriptive, concerning it, which he was able to furnish, were the following:

This mass of iron was brought down from Fort Pierre to St. Louis by the American Fur Company's steamer in charge of Mr. C. P. Chouteau, in 1857, and by him presented to the Academy, in the spring of 1858. It was said to have been found in Nebraska Ter., at a point about twenty miles from Fort Pierre, which is situated on the right bank of the Missouri river, in Lat. 44° 19′, Long. 100° 26′ nearly. The weight of it, when found, was 35 lbs.: when presented to the Academy, it weighed 30½ lbs., a piece having been previously cut off as a specimen. Since that time, two other specimens, weighing together about 8¼ lbs., had been cut off, at the same end, and presented by the Academy, the one to Prof. C. U. Shepard of New Haven, and the other to the Imperial Mineralogical Museum of Vienna. A portion of the cut surface is visible at *a* in the accompanying plate. (Pl. XXI.)

In form and shape it was irregular, somewhat flattened, with rounded corners and obtuse edges. On three sides, the surface was covered with irregular depressions or indentations. One of these sides, being a concave surface filled with these indentations, or wavy depressions, is seen in the plate in the front view. The color of the outside was brownish black; the inside (cut or fracture) had the light gray metallic color of iron; and the cut surface showed flaws in the mass. The outside color was merely superficial, and there had been but a slight degree of oxydization of the surface. Prof. C. U. Shepard, who had an opportunity of examining it, thought it could not have been upon our earth more than some four or five years. The iron was soft under the cutting tool, and the workmen engaged upon it, as well as Mr. Albert Dwelle, foreman of the Fulton Foundry, whose attention had been called to it, at the time, had been well satisfied that they observed a distinct smell of something like camphor in the process of cutting.

The length was 11 inches, breadth 4.6 inches; thickness at one end, 6 inches, at the other, 3 inches, tapering suddenly to an obtuse edge.

Prof. Litton, to whom it had been referred for examination, having been prevented by illness and unavoidable absence from completing the analysis, which he had begun, Dr. H. A. Prout had kindly consented to undertake the work in his stead, the result of which he had communicated in the following note:

St. Louis, August 20, 1860.

N. Holmes, Esq., Cor. Secretary of the Academy of Science.

Dear Sir:—You will find below the result of the analysis, which I have made, of the Meteoric Iron, which was referred to me.

One thousand parts of the mass yield:

Iron	942.88
Nickel	71.85
Magnesium	6.50
Calcium	3.50
Sulphur	tr.
	1024.73

It will be seen from this, that it is nearly pure nickeliferous iron; and as it has about the usual proportion of iron, its meteoric origin cannot be a matter of doubt. It should have been polished, in order to have shown the beautiful crystaline structure which is exhibited in these strange visitors from the outer regions of space. The Nickel is entirely free from traces of Cobalt, Chromium, Manganese, or other elements sometimes found in these masses. With sentiments of the highest regard,

Yours truly,

H. A. PROUT.

Mr. Henry Engelmann exhibited a beautifully executed Map of the region of the Little Colorado river, intended to illustrate Lieut. J. C. Ives' Report of the U. S. Expedition for the exploration and survey of that river, in 1858, now in course of publication, and drawn and engraved by Mr. Frederick Egloffstein, the topographer of the Expedition. By means of different shadings, this map is made to represent the topographical features of the country in a much more distinct and satisfactory manner than has been hitherto attained.

Tr

Plate XXI.

L. Gast, Bro. & Co. Lith. St. Louis, Mo.

LIST OF THE OFFICERS AND MEMBERS

OF THE

ACADEMY OF SCIENCE OF ST. LOUIS,

IN 1860.

President,
HIRAM A. PROUT, M.D.

First Vice-President,
GEORGE ENGELMANN, M.D., A.A.S.

Second Vice-President,
CHAS. A. POPE, M.D.

Corresponding Secretary,
NATHANIEL HOLMES, A.M.

Recording Secretary,
MONTROSE A. PALLEN, M.D.

Treasurer,
J. S. B. ALLEYNE, M.D.

Librarian,
G. H. E. BAUMGARTEN, M.D.

Curators.

T. C. HILGARD, M.D.
C. W. STEVENS, M.D.
EDWIN HARRISON, S.B.,
G. H. E. BAUMGARTEN, M.D.

Committee of Publication.

N. HOLMES, A.M.
W. M. MCPHEETERS, M.D.
G. ENGELMANN, M.D.

Committee on Library.

C. A. POPE, M.D.
Hon. SAMUEL REBER,
G. H. E. BAUMGARTEN, M.D.

Committee on Finance.

SPENCER SMITH,
JAMES B. EADS,
CHARLES C. WHITTELSEY.

Corresponding Members.

Agassiz, Prof. Louis, LL.D., A.A.S., F.R.S., &c. Cambridge, Mass.
Ayres, W. O., M.D. - - - - San Francisco, Cal.

Bache, A. D., LL.D., A.A.S., &c. &c., Sup. of the U. S. Coast Survey, - - -	Washington, D. C.
Baird, Prof. S. F., A.A.S., Assis't Sec. S. I.	" "
Barris, W. H. - - - - - -	Iowa City, Iowa.
Beebe, Edward H. - - - - - -	Galena, Ills.
Behr, Hermann, M.D. - - - - -	San Francisco, Cal.
Bent, Silas - - - - - - -	Chicago, Ills.
Billings, E., F.G.S. - - - - -	Montreal, Can.
Binney, G. W. - - - - - -	Germantown, Pa.
Blatchford, Thos. W., M.D. - - - -	Troy, N. Y.
Broadhead, G. C. - - - - - -	Columbia, Mo.
Brown, B. B., M.D. - - - - -	Sacramento, Cal.
Bryan, Lieut. F. T., Top. Engrs. U. S. A.	Washington, D. C.
Bunsen, Charles - - - - - -	St. Clair Co., Ills.
Bunsen, George - - - - - -	" " "
Culbertson, Alexander - - - - -	Nebraska Ter.
Dall, Rev. Chas. H. A., A.M. - -	Calcutta, E. Ind.
Daniels, Prof. Edward - - - - -	Madison, Wis.
Davidson, Thomas, F.G.S., F.R.S. -	London, Eng.
Dawson, Alexander - - - - -	Nebraska Ter.
Deming, C. M. - - - - - -	" "
Dowler, Bennet, M.D., F.R.S. N. Antiq., &c. &c.	New Orleans, La.
Dudding, Richard - - - - -	Oregon.
Dunglison, Prof. Robley, M.D., S.P.A.S.	Philadelphia, Pa.
Ehrenberg, Hermann - - - - -	Arizona Ter.
Emmons, Prof. E. - - - - -	Albany, N. Y.
Engelmann, Henry - - - - -	Washington, D. C.
Evans, John, M.D. - - - - -	" "
Flagg, Willard C. - - - - - -	Moro, Ills.
Fleming, R. B., M.D. - - - - -	Mine La Motte, Mo.
Fry, Major Carey H. - - - - -	Fort Union, N. T.
Galpin, Charles - - - - - -	Nebraska Ter.
Gilpin, Col. William - - - - -	Independence, Mo.
Giroux, A. - - - - - - - -	Nebraska Ter.
Hagenow, Frederick von - - - - -	Greifswalde, Prussia.
Haidinger, Prof. W., S.P.A.S., &c. &c., Director of the Imp. Geol. Inst. of -	Vienna, Austria.
Hall, Prof. James, A.A.S., S.P.A.S. -	Albany, N. Y.
Harney, Maj. Gen. Wm. S., U. S. A. -	St. Louis, Mo.
Hawn, Maj. F. - - - - - -	Weston, Mo.
Hayden, F. V., M.D., - - - - -	Albany, N. Y.
Henry, Prof. Joseph, LL.D., A.A.S., &c. &c. Sec. S. I. - - - - - -	Washington, D. C.
Henry, J. C., M.D. - - - - -	Fort Union, N. T.
Higginbotham, Rev. John - - - -	Halifax, N. S.
Hodgkiss, H. - - - - - - - -	Nebraska Ter.
Holden, Edward - - - - - -	Jackson Co., Ills.
Horine, Solomon, M.D. - - - - -	Memphis, Tenn.
Hough, Warwick - - - - - -	Jefferson City, Mo.
Hoy, P. R., M.D. - - - - - -	Racine, Wis.

Huguet-Latour, Capt. L. A., V.M.R. -	Montreal, Can.
Hunt, T. Sterry, A.M., A.A.S. - - -	" "
Jackson, Prof. J. B. S., M.D., A.A.S. -	Boston, Mass.
King, Henry, M.D. - - - - -	Washington, D. C.
Kipp, A. - - - - - - - -	Nebraska Ter.
Lane, Hon. E. - - - - - -	Chicago, Ills.
Lapham, I. A. - - - - - -	Milwaukie, Wis.
Le Conte, John L., M.D., S.P.A.S., &c. &c.	Philadelphia, Pa.
Leidy, Prof. Joseph, M.D., A.A.S., &c. &c.	" "
Lindheimer, Ferdinand - - - - -	New Braunfels, Tex.
Locke, Prof. John - - - - -	Columbia, Mo.
Logan, Sir Wm. E., F.G.S., F.R.S., A.A.S.	Montreal, Can.
Lyon, Sidney S. - - - - - -	Jeffersonville, Ind.
McAdams, William, Jr. - - - - -	Jerseyville, Ills.
McClellan, Capt. Geo. B. - - -	Chicago, Ills.
McGregor, A. L., M.D. - - - - -	Chamois, Mo.
McMasters, Rev. S. Y., D.D., LL.D. -	Palmyra, Mo.
Marcou, Prof. Jules - - - - - -	Boston, Mass.
Marcy, Capt. R. B., U. S. A. - - -	Washington, D. C.
Marsh, Hon. Geo. P., LL.D., A.A.S., &c. &c.	Burlington, Vt.
Meek, F. B. - - - - - - - -	Albany, N. Y.
Mosblech, Prof. P. W., Ph.D. - -	Bethany, Va.
Norris, Benjamin, M.D. - - - - -	Pittsfield, Ills.
Norwood, Prof. J. G., M.D. - - -	Columbia, Mo.
Pope, Capt. John, U. S. A. - - -	Washington, D. C.
Rauch, John H., M.D. - - - - -	Burlington, Iowa.
Reuss, Adolphus, M.D. - - - - -	Belleville, Ills.
Riddell, Prof. J. L., M.D. - - - -	New Orleans, La.
Riddell, Prof. W. P., M.D. - - - -	Austin, Tex.
Russell, Prof. John - - - - -	Bluffdale, Ills.
Ryland, Kirtly, M.D. - - - - -	Belleville, Ills.
Schoeneich, Henry, M.D. - - -	St. Charles, Mo.
Schultz, C. H., M.D. - - - - -	Deidesheim, Bav'a.
Seeman, Berthold, Ph.D. - - -	London, Eng.
Sharswood, William, A.M., Ph.D. - -	Philadelphia, Pa.
Sheldon, Prof. D. S. - - - - -	Davenport, Iowa.
Shepard, Prof. Charles U., M.D., A.A.S.	New Haven, Conn.
Shumard, George G., M.D. - - -	Austin, Texas.
Sloan, Wm. J., M.D., Sur. U. S. A. -	Santa Fé, N. M.
Snyder, John F. - - - - - -	Bolivar, Mo.
Snyder, William - - - - - -	Belleville, Ills.
Steele, George, M.D. - - - - -	Austin, Texas.
Suess, Prof. Edward - - - - -	Vienna, Austria.
Swallow, Prof. G. C. - - - - -	Columbia, Mo.
Trécul, M. Auguste - - - - -	Paris, France.
Vaughan, Col. A. J., U. S. Indian Agent,	Nebraska Ter.
Warren, Lieut. G. K., Top. Engrs., U. S. A.	Washington, D. C.
Wheeler, G. W., M.D. - - - - -	Perryville, Mo.

White, Rev. George	Florence, Ala.
White, C. A.	Burlington, Iowa.
Whittelsey Charles	Cleveland, O.
Williams, Dr. ——	Crawford Co., Mo.
Worthen, Amos H.	Springfield, Ills.
Yandell, Prof. L. P.	Louisville, Ky.

Associate Members.

Angelrodt, E. C.
Allen, William S.
Allen, Gerard B.
Alleyne, J. S. B., M.D.
Armstrong, Col. D. H.

Barnett, George I.
Barret, Hon. J. Richard
Bates, Hon. Edward, LL.D.
Baumgarten, E. F., M.D.
Baumgarten, G. H. E., M.D.
Berkeley, Rev. Edward F.
Berthold, Amadée
Blank, Oscar, M.D.
Bliss, Willard F.
Blow, Henry T.
Blow, Taylor
Boerner, Edward, M.D.
Boisliniere, L. C., M.D.
Boyle, F. T. L.
Bredell, Edward, Jr.
Buckland, James

Campbell, Robert
Casselberry, Evans
Cavender, John
Chappell, Wm. H.
Chouteau, Charles P.
Churchill, F. A.
Clark, Maj. M. Lewis
Coale, Samuel A.
Collet, Oscar
Colt, Hon. James B.
Cozzens, Frederick S.
Cronenbold, F. W.

Day, Thomas E.
Dick, Franklin A.

Eads, James B.
Edwards, Richard
Eliot, Rev. Wm. G., D.D.
Engelmann, Geo., M.D., A.A.S.

Farrar, J. O'Fallon, M.D.
Farrar, Benjamin
Farrar, B. G.
Filley, Giles F.
Filley, Edward A.
Fischer, Gustave, M.D.
Forbes, Dr. Isaiah

Gast, Leopold
Gaty, Samuel
Glasgow, Wm., Jr.
Golding, W. S., M.D.
Goodson, John E.
Gray, Melvin L.
Gregory, E. H., M.D.

Hamilton, Hon. Alexander
Hansmann, C., M.D.
Harrison, Edwin, S.B.
Hauck, F., M.D.
Hickman, Benj. F.
Hilgard, T. C., M.D.
Hill, Britton A.
Hitchcock, Henry
Hodgen, Prof. John T., M.D.
Holmes, Nathaniel, A.M.
Holmes, Samuel A.
Homes, William
How, John
Hutchinson, Rev. E. C., D.D.

Johnson, George, M.D.
Johnson, Prof. John B., M.D.

Kennard, Thomas, M.D.
Kennett, Hon. Luther M.
Kercheval, R. M. V.
Kershaw, J. M.
Koch, Albert C., Ph. D.
König, Hermann
Krum, Hon. John M.

Larkin, James R.
Leigh, Edwin, M.D.
Leitch, Alexander
Lemoine, E. S., M.D.
Linton, Prof. M. L., M.D.
Litton, Prof. A., M.D.
Loughborough, John
Luke, John W.

McDowell, Augustus
McPheeters, Rev. S. B.
McPheeters, Prof. W. M., M.D.
Mackenzie, Kenneth
Maffit, William, M.D.
Mason, Edwin R.
Meyer, Francis A.
Miller, Edward, C. E.
Moses, S. Gratz, M.D.

Newton, Rev. T. H.

O'Fallon, Benjamin
Oliphant, R. W., M.D.
Oliver, Caleb

Pallen, Prof. M. M., M.D.
Pallen, Montrose A., M.D.
Partridge, George
Peabody, Rev. Charles
Pennell, Calvin S.
Phillips, John V.
Pollak, S., M.D.
Pope, Prof. Charles A., M.D.
Post, Prof. T. M., D.D.
Proctor, Rev. Alexander
Prout, Hiram A., M.D.

Ranlett, Seth A.
Reber, Hon. Samuel
Reid, James C., C. E.
Reynolds, Prof. J. J.
Robinson, George R.
Roesch, Charles, M.D.

Sander, Enno, Ph.D.
Schiel, James, M.D.
Schuyler, Rev. Montg'ry, D.D.

Seyffarth, Prof. G., Ph.D., D.D., M.R.A.S., &c. &c.
Shaw, Henry
Sherman, Eleazer
Shumard, Benj. F., M.D.
Smarius, Rev. C. F., S. J.
Smith, E. F., M.D.
Smith, James
Smith, James, Jr.
Smith, Spencer
Smith, Wm. H.
Snead, Thomas L.
Soulard, Benj. A.
Soulard, James G.
Stevens, Prof. Chas. W., M.D.
Stieren, H. L., M.D.
Strong, Newton D.

Taussig, William
Tirrell, N. D.
Todd, Albert

Vallé, Néré
Vanderford, Wm. H.

Wade, William
Walker, G. S., M.D.
Washington, J. R., M.D.
Watters, Prof. J. H., M.D.
Weyden, Ernest
Whittelsey, Charles C.
Wilgus, James L.
Wislizenus, A., M.D.
Witter, Conrad
Woods, Rev. D. B.
Woods, Robert K.
Wyman, Edward

Yeatman, James E.

ERRATA.

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p. 80, line 8 from bottom, for 520, read 420.
p. 155, " 9 " " for *facta*, read *farcta*.
p. 206, " 11 " " for *Lexingtonensis*, read *Lexingtonense*.
p. 237, " 4 " " for *orbiericribrati*, read *orbicribrata*.
p. 269, " 1, for *cribriformis*, read *cribriforme*.
p. 293, " 20, for *sulcifera*, read *sulciferus*.
p. 296, " 11, for *Camaraphoria*, read *Camerophoria*.
p. 339, " 8, for *Cascuta*, read *Cuscuta*.
p. 397, " 11 from bottom, for *securus* read *securis*.
p. 527. (Plates p. 2, No. 24.) This group begins, according to the original which Dr. Seyffarth has seen since, with the figure of a lamp (see Plates p. 5, No. 3); wherefore those three hieroglyphs pronounce *kere kba pe*, and translate: lumen ultionis, the illustrious avenger. Compare p. 533, No. 24.
p. 532, line 19, for *stati*, read *stali*.
p. 535, " 2 from bottom, for *hosen*, read *hos en*.
" " 12 " for *form*, read *farm*.
p. 536, " 7, for *ex oratis*, read *exaratis*.
" " 29, for *e. g.*, read *i. e.*
p. 537, " 11, for *rompl*, read *rompi*.
" " 15 from bottom, for *mona*, read *mana*.
" " 20 " for *mor*, read *mn*.
p. 545, " 20, for "*Decanus, Chmus*," read *Decanus* "*Chmus*."
p. 546, " 10, for *expressed in a figure*, read *expressing a word*.
p. 547, " 26, for *Gram. Aeg., and Erste*, read *Gramm. Aeg., Erste*.
p. 548, " 8 from bottom, for *Hebraeisshen*, read *Hebraeischen*.
" " 14 " for *Hieroglyphensystem*, read *Hieroglyphensysteme*.
" " 27 " for י, read ו, *u* (the ancient Y cet.)
p. 549, " 5, for *syllables differing in letters*, read *syllables and letters differing*.
p. 550, " 21 from bottom, for *to to make*, read *to make*.
p. 551, " 20, for c *in chou*, read *e in ehou*.
p. 555, " 21, for *joculis*, read *jaculis*.
p. 556, " 5 from bottom, for *B. C.*, read *before Champollion*.
" " 8 " for 1843, read 1845.
p. 562, " 6 " for *corruptly*, read *correctly*.
p. 614, the bracket under "subcarboniferous series" should stop at the top of "*q*. Black Slate," the rest being Devonian.
p. 631, lines 26, 27, for *thin*, read *three*.
p. 632, in note, for *in generic formula*, read *See generic formula*.
p. 633, lines 4, 8, for *thin*, read *three*.
p. 634, line 6–7, for *in the sixteenth*, read *in* 66-100*ths*.
" " 21, for *places*, read *place*.
" " 32, for 60-100*ths*, read 66-100*ths*.
p. 640, " 32, for *Copoerensis*, read *Cooperensis*.

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